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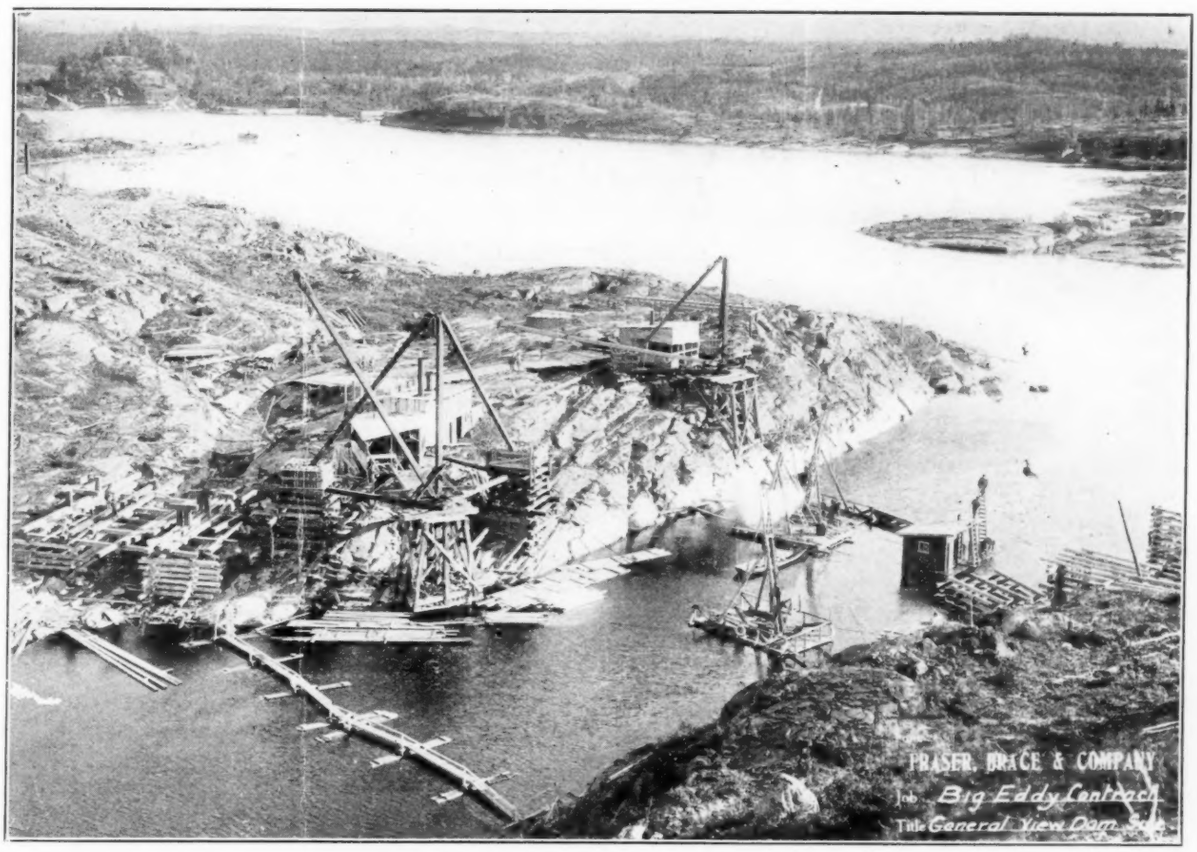

GENERAL VIEW OF SITE OF BIG EDDY DAM

In this issue:

Big Eddy Storage Dam
Comparison of Gasoline and Electric Pumping
The Wanaque Dam
Concrete Sewer Standard Specifications

NEW YORK, APRIL 17, 1920

What are the Essentials
of a Correctly-Designed Pavement?

THE years have proved the following to be the fundamental features of a correctly-designed pavement.

1. It must have a strong supporting foundation.
2. This foundation must be protected from the destructive action of traffic by a resilient wearing course which can be economically maintained in perfect condition.

The supporting foundation may be built in various ways of various materials — the primary requisite being sufficient mass and strength to support the traffic load.

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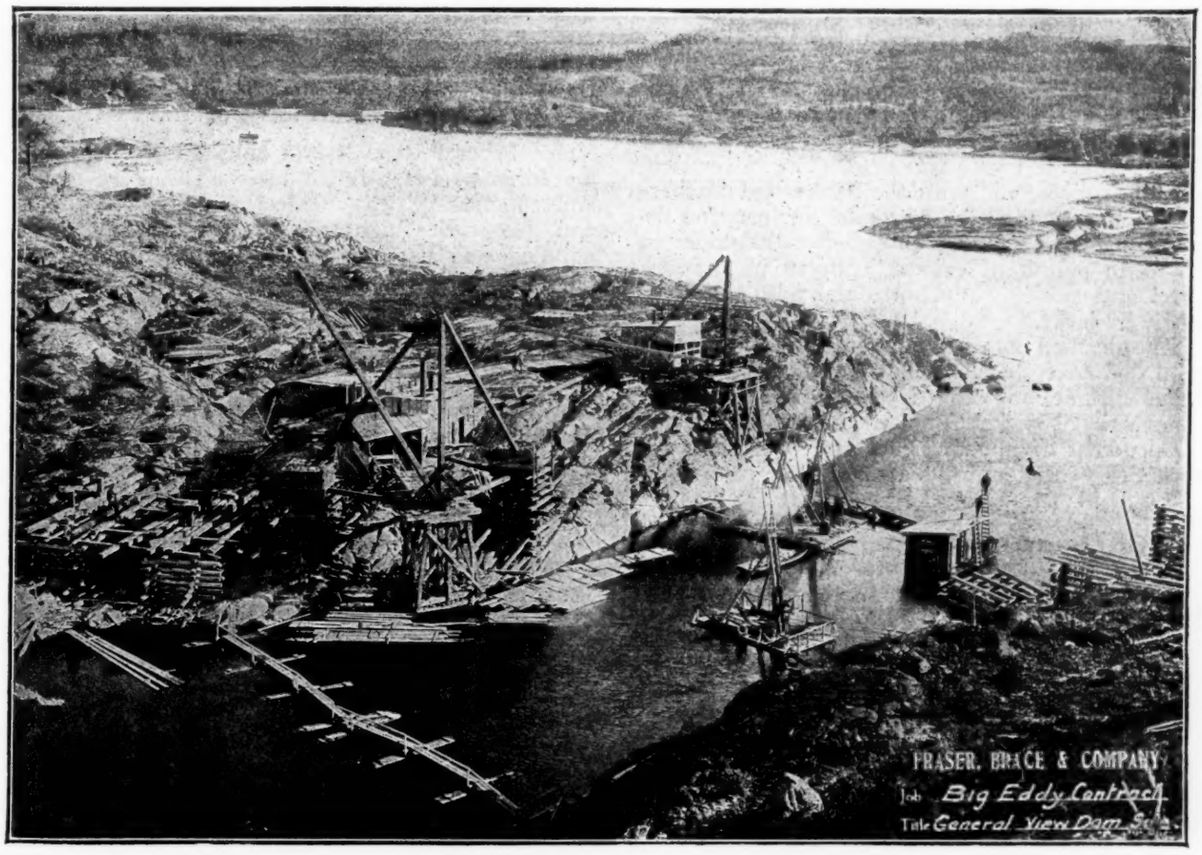
Vol. 48 NEW YORK, APRIL 17, 1920 No. 14

Big Eddy Storage Dam

Concrete structure 1,100 feet long and 159 feet high built in sections in rocky bed of Spanish River, Canada, to serve hydro-electric plants. New York contractors reconstructed miles of railroad, leveled river bed under water, excavated by-pass channel in rock, constructed workmen's camp for 700, and equipped field shops and power plant for construction purposes.

The Big Eddy Dam is now in an advanced stage of construction across the channel of the Spanish River at Turbine in the province of Ontario, Canada, about 4¼ miles from the Soo Line of the Canadian Pacific Railroad, and about 25 miles from the International Nickel Company's mine and smelter, where it is being built in order to provide additional water storage and regulate the river flow for the nickel company's hydro-electric plants located lower down in the river valley.



GENERAL VIEW OF SITE OF BIG EDDY DAM.

LOGHOUSE WATERPROOFED WITH BUILDING PAPER FOR PRELIMINARY CAMP.

The Spanish River has a flow varying from 1,600 second-feet to 16,000 second-feet at the dam site which is in a narrow rocky gorge 130 feet wide, with a normal depth of water there of 45 to 55 feet. The low water velocity is about 4 miles per hour and the river is subject to severe floods and heavy ice fields that make any channel construction difficult and expensive.

The 6,000-acre storage reservoir to be created by the dam, will extend 20 miles upstream and will have a maximum depth of about 100 feet. The dam itself is of concrete with a gravity section about 100 feet wide at the base and 159 feet high to the lowest point of the foundation carried to satisfactory bearing below the original surface of the river bed. The length is 1,100 feet consisting of a 512-foot bulkhead, a spillway section having 19 openings, 17 feet wide between piers, a 152-foot section with four steel penstocks 12 feet 6 inches in diameter, and an exciter penstock 5 feet in diameter and provisions for a trash run and log slide.

The regulating sluice section is 60 feet long and is located in the river section. When the river is not running over the spillway, the flow will be controlled by discharging through three 78-inch Larner-Johnson valves, having a combined capacity of 3,700 second-feet with full head. The valves weigh 25 tons apiece, and with the intake and discharge tube connections weigh 52 tons. For erection they were suspended by rods threaded at the upper end so as to permit of easy adjustment in regard to level and grade, while horizontal adjustment was made by jacks.

The finished dam will contain about 88,000 yards of 1:2:3 concrete made with gravel from a pit 15 miles distant, and slag from the smelters of the International Nickel Company and containing up to 20 per cent of plums. The contract for the construction of the dam was awarded to Fraser, Brace & Co., Ltd., Montreal and New York.

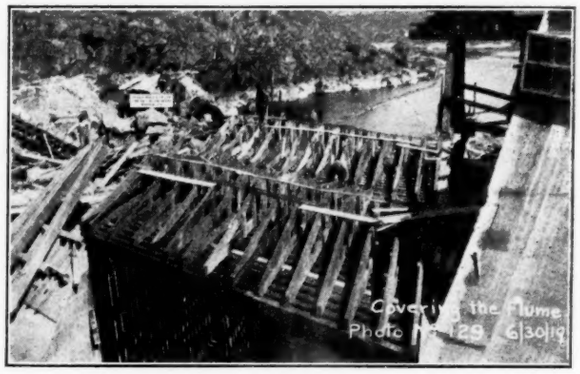
PRELIMINARY OF OPERATIONS.

Work was commenced in August, 1918, by the contractor, who, to facilitate transportation of plant, equipment and materials to the dam site reconstructed 3½ miles of standard gage railroad, previously laid from the Canadian Pacific Railway and Algoma Eastern Railway tracks at Turbine, which they relaid with heavier rails, improved the grade and alignment, and extended it ¾ of a mile farther through very rough country involving 6,550 yards of rock excavation, 6,100 yards earth cut, 5,000 yards of borrow pit excavation, and the construction of a wooden trestle 945 feet long and 50 feet high.

Preparations were made at the outset to provide for about 700 men for two years or more at this remote point in the wilderness where there was no improvements, and where the long winters are very severe, with deep snow and intense cold. A camp was, therefore, immediately built at the site with three dining room and kitchen buildings, each having a capacity for 225 men, besides the bunk houses, commissary, cottages, offices, store houses, shops and other buildings.

Close to the dam the surface of the ground is so rough and broken that no attempt was made to place the buildings there and they were located on a side hill where it was necessary to make the larger buildings long and narrow to avoid considerable expense in levelling the site.

Most of the bunk houses are 35 feet wide and from 100 to 150 feet in length but are divided into sections by transverse partitions 13 feet apart, thus making separate quarters for groups of 16 men



TEMPORARY TIMBER CONSTRUCTION OVER FLUME TO CARRY WET CONCRETE OF MAIN DAM.

each. Several 16 x 24-foot houses were built for the foremen and married men. The store house and commissary was 30 feet wide, 75 feet long and two stories high and the 30 x 35-foot office building was also two stories high. The kitchen, office and most of the bunk houses are heated from a central heating station containing three vertical type boilers and a general washroom provided with hot and cold shower baths and wash basins. Temporary quarters were at first provided by log cabins which were replaced with framed and sheeted houses as soon as the sawmill was put in operation.

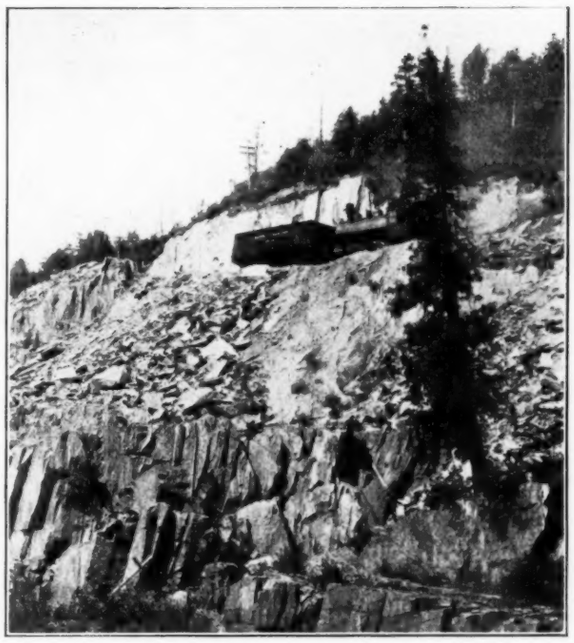
Compressed air to operate rock drills, hoisting engines and other machinery and for the pneumatic caissons used in the cofferdam and foundation work was provided by one low pressure compressor with a capacity of 1,200 feet, one high pressure compressor with a capacity of 500 feet, and two high pressure compressors with capacities of 1,050 feet per minute all operated by steam from a battery of five 100 h. p. bricked-in type boilers that were later superseded by electric motors operated by current received from the Nickel Company's plant at High Falls 25 miles distance. This current was received at a small transformer house at 35,000 volts and stepped down to 550 volts for the motors and 110 volts for lighting.

The power house operates the lathe, shaper, threading machine, drill press and power hack saw in the machine shop and the band saw, rip saw, rip and butt saw, swing saw and planer in the carpenter shop and is available for any purpose necessary in the adjacent smith shop.

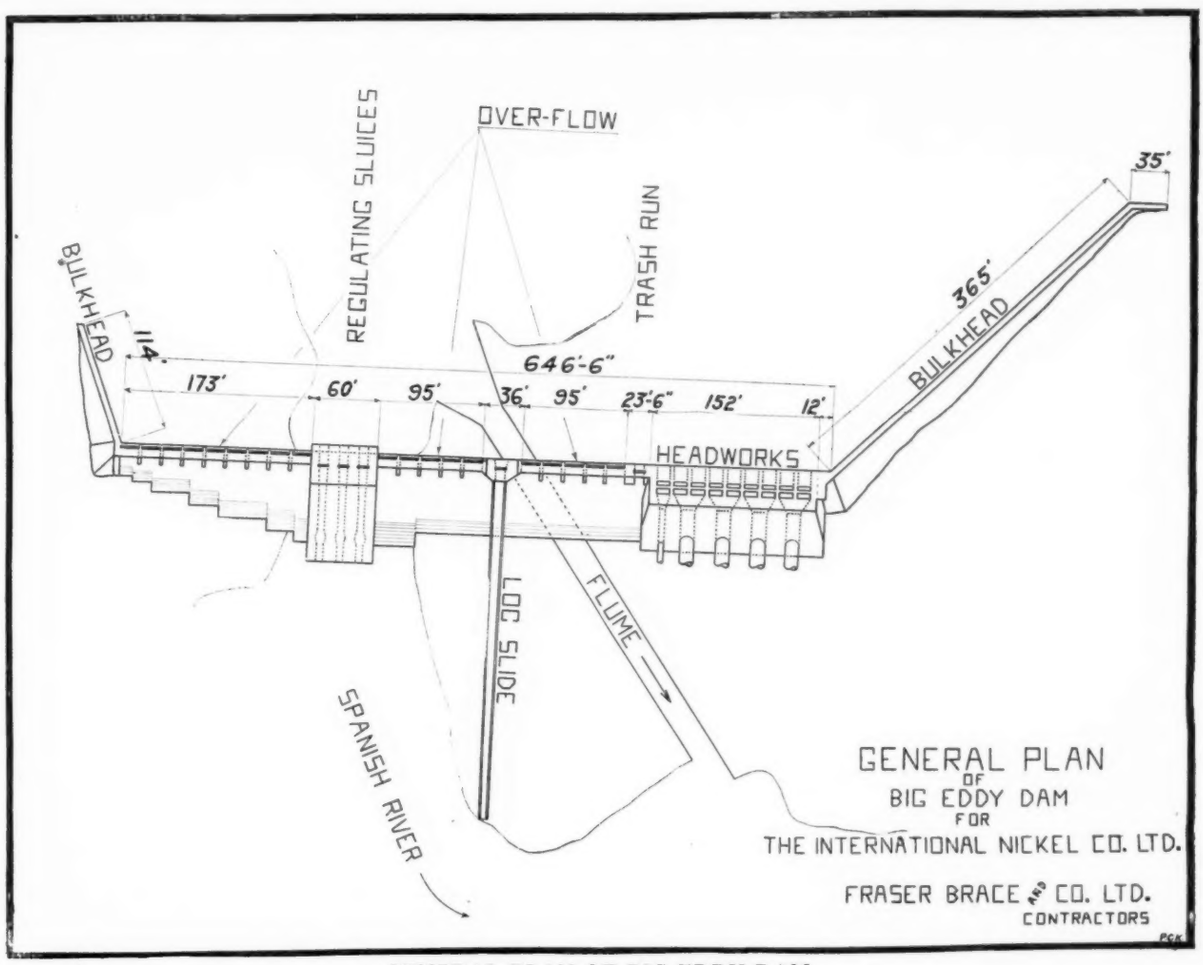
BY-PASS CHANNEL.

In order to divert the river from the dam site and allow the latter to be unwatered between the cofferdams, an artificial channel, called a flume, 25 feet wide, 28 feet deep, and 550 feet long, was excavated through earth and rock in a slight natural depression about 100 feet back from the east bank of the river. This channel, which was really a canal rather than a flume, required 14,000 yards of solid rock excavation which, after being blasted was loaded by stiffleg derricks into 6-yard cars, run out on a service trestle and dumped in piles on the river bank where it was accessible to be later reclaimed and used for plums in the massive concrete.

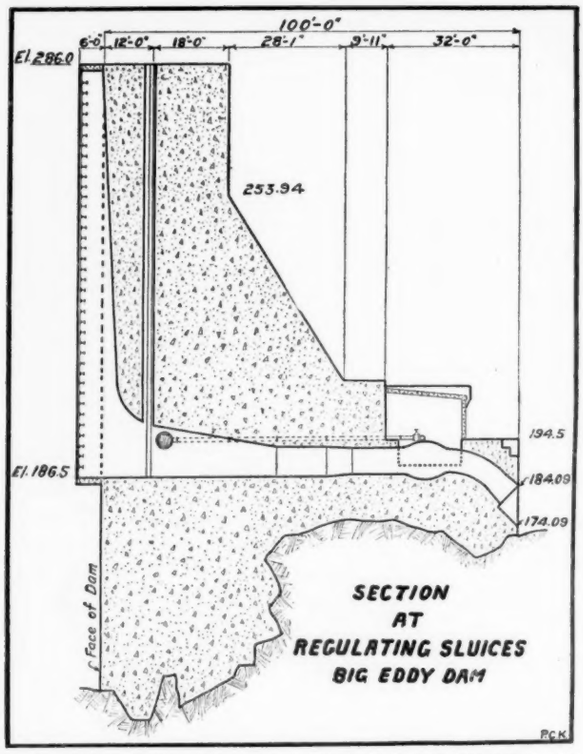
Where the by-pass intersects the permanent dam, the bottom and sides were lined with concrete and bearings were provided at the upstream and downstream faces of the dam or stoplog so as to enable the flow through the east flume to be regulated at will.



ROAD TO BIG EDDY DAM.
Showing difficult nature of country for transportation.



GENERAL PLAN OF BIG EDDY DAM.



SHOWING GENERAL AND SPECIAL FEATURES OF CROSS-SECTION AND EXTREME IRREGULARITY OF ROCK FOOTING.

Later on as the elevation of surface of the concrete in the main dam was carried up above the bottom of the flume, the latter was covered up 42 feet above its floor, by a roof consisting of lagging supported on wooden beams and trusses forming a sort of saw tooth construction that supported the wet concrete above it and enabled the dam to be built full length continuously above the flume while the latter was in service, supplemented by sluices in the lower part of the dam. When the water of the channel of the river had been raised 5 feet above normal by the cofferdam, the flume readily carried off the average summer flow of 1,500 second-feet and even handled an increased flow of 5,300 second-feet without injury to the cofferdam

LEVELLING THE RIVER BOTTOM.

At the dam site, the rock bottom of the channel was originally pitched steeply with the axis of the dam and upstream, and was covered up to a depth of 30 feet with large and small boulders and debris from the adjacent banks, making it very difficult to begin the construction of either the cofferdams or the foundation for the permanent structure.

The bottom was therefore approximately levelled by submerged drilling, blasting and excavation. Floats, equipped with Ingersoll-Rand drills, were moored in the channel and holes from 10 to 15 feet deep were drilled in the bolders and in the surface of the rock wherever necessity was indicated by soundings. Casing pipes were inserted in the holes and through them charges of 60 per cent dynamite were placed that, when fired, levelled the bottom sufficiently to give necessary bearing for the cribs and for the cutting edges of the caissons.

After the levelling was substantially completed, the bottom was inspected by divers who in some places built up piers of concrete bags to form temporary supports, sometimes several feet high, to conform to the irregularities remaining in the bottom and give necessary bearing for the caissons.

Comparison of Gasoline and Electric Pumping

At the water works plant of the Windsor, Conn., Fire District an electrically operated pump is found to be 20 per cent cheaper to operate than a gasoline one, and reliable as well as convenient to operate.

By H. R. Turner *

The water supply for the town of Windsor in Hartford county, Connecticut, is obtained from an impounding reservoir situated on the west edge of the town. From here the water is pumped to a standpipe one and one-eighth miles east of the reservoir and is supplied thence by gravity to the town, where it provides water for a population along the pipe lines of about 4,000 inhabitants.

The water company, a private corporation, owned the plant until 1915, when it was purchased by the Windsor Fire District, an incorporated part of the town of Windsor. Material enlargements to the pumping plant and distribution system were made at this time under the supervision of the writer. The pumping station in 1915 consisted of a pair of No. 80 Rife rams and a 10 h. p. single-cylinder, 4-cycle, vertical gasoline engine direct-connected to an 8x12-inch Goulds triplex single-acting pump, having a capacity of 300 gals. per minute. This machinery was housed in a frame building 16 ft. by 24 ft., constructed of stucco on wire lath, with a tin roof.

The gasoline driven unit was retained and modified to suit an increased head pumped against, due to the erection of a standpipe 105 ft. high. The

*Engineer-manager Windsor Water Department.

modification was accomplished by changing the gear ratio on the pump, reducing the volume of water pumped from 300 to 200 gals. per minute. This outfit is now in use as a spare unit for emergency pumping only.

NEW ELECTRIC PUMP.

The new pumping equipment installed in 1915 consisted of a 10x12-inch Smith-Vaile triplex, double-acting pump, having a capacity of about 1,050 gals. per minute, and operated by a 100 h. p. Westinghouse slip ring motor, through chain drive. Power was furnished by the Hartford Electric Light Company at 4,800 volts, reduced to 220 volts at the station. The apparatus was controlled automatically by a Westinghouse alternating current magnet switch starter, actuated by a pressure gauge switch. This automatic starter provides for emergency operation, but under normal operating conditions an attendant is present to care for oiling, chlorine control, etc.

The power is sold by the Hartford Electric Light Company in accordance with the following monthly schedule:

	Per k.w.
1st 500 k.w.	$0.05
1,000 k.w.	.04
3,500 k.w.	.032
65,000 k.w.	0.19

From these rates a reduction of 40 per cent is allowed for pumping between 10 p. m. and 7 a. m. On this account the pumps are operated between these hours unless an emergency requires operation during the day time. The current consumed averages 0.98 k.w. per 1,000 gals. pumped.

The gasoline driven unit is supplied from a 500-gal. storage tank in the ground outside the pumping station, which is piped direct to the engine. The gasoline consumption is about 1.04 gals. per 1,000 gals. of water pumped. This outfit is operated for emergency only.

OPERATING COSTS.

The actual fuel operating costs of the two units are as follows:

	Per 1,000 gals.
Gasoline driven pump	$0.025
Electric	.017

TESTING PUMP WITH CALIBRATED NOZZLE AND PITOT TUBE.
Arrow points to chlorine house.

WINDSOR PUMPING STATION.

These figures are based on gasoline at 24 cents per gallon wholesale price in December, 1919, and electric power on the sliding scale as above noted for one month's cost in which 9,215,000 gals. were pumped at a cost of $156.53.

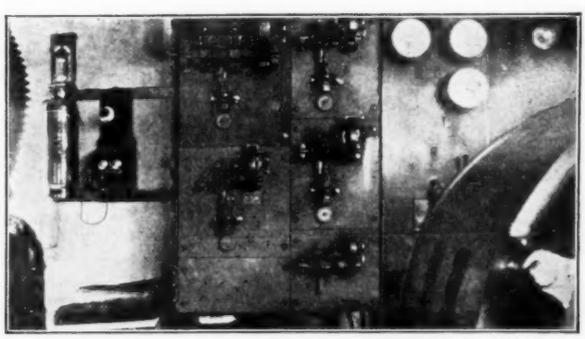
The total operating cost of the electric driven unit for six months' operation ending December 1, 1919, was $1,265.53, for a pumpage of 45,913,000 gallons. This is equivalent to $0.0276 per 1,000 gals. pumped. The dynamic head pumped against is 273 ft., and the cost of pumping 1,000,000 gals. raised one foot is $0.101. The above figures for six months' operation cover oil and grease, attendant, power charges and repairs, but do not cover interest on investment or depreciation.

An approximate comparison of costs of gasoline and electric driven pumps under our conditions is as follows:

	Gasoline, cost per 1,000 gals.	Electric, cost per 1,000 gals.
Attendant	$0.0081	$0.0081
Power	.0250	.0170
Oil, grease, etc.	.0005	.0009
Repairs	.0011	.0016
Total operating costs	$0.0347	$0.0276

A comparison of the depreciation and interest charges cannot be made easily, since the two units are so different in size and capacity, being about one for the gasoline to five for the electric pump.

Operating conditions are not ideal by any means. There is no filtration plant, and the water pumped often contains grit and sand during periods of high run-off on the streams entering the reservoir. This requires frequent and regular inspection of pump



AUTOMATIC STARTING EQUIPMENT.
Pressure gauge switch in the upper right-hand corner.

valves and piston packings in order to reduce slippage to its lowest amount. We have adopted a valve known as the Branden valve, which is a hard-rubber valve reinforced with metal to reduce danger of breakage. Piston packing, known as Goodsell's Dollar Packing, which is stitched on the outer edge, has been found to have a longer life than ordinary types, which soon deteriorate under our operating conditions.

While the electric power is not absolutely reliable, we have never been without power for more than six or seven hours at one time, and those occasions are very infrequent. Under general conditions in this locality the writer would not hesitate to recommend an electric power installation rather than a gasoline or fuel oil unit, since the advantage of simplicity of operation and self-contained machinery more than offsets the charge of unreliable service which an experience of five years in this location has shown to be negligible.

The Wanaque Dam

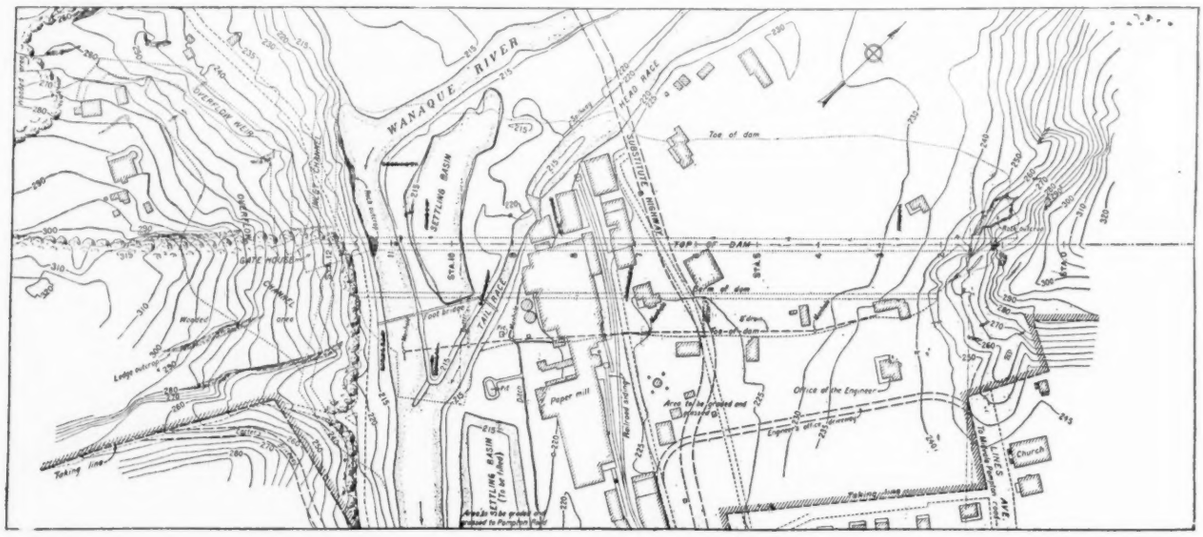
North New Jersey water supply to be provided by impounding run-off from a 94-square-mile water shed in a reservoir of eleven billion gallons capacity, formed by constructing an earth dam 75 feet high and 1,200 feet long, to be built in about 3½ years. Special construction features are involved by the requirements of the rigid specifications for imperviousness of embankment and concrete; extreme depth of core-wall trench, and the maintenance during the first year of construction operations of continuous flow in this river and a water supply to a large paper mill that will remain located and operating near the center of the dam site for months while construction is in progress around it. Up-to-date, sanitary requirements. Rational classification of excavation items.

The North Jersey District Water Supply Commission of the State of New Jersey proposes to construct a large impounding reservoir on the Wanaque River, with a total capacity of about 11,000,000,000 gallons. It will be formed by building a large earth dam to be known as Wanaque Dam. The work is located near the villages of Wanaque and Haskell in the County of Passaic, State of New Jersey, and is about 11 miles northwest of the City of Paterson.

The work will include the construction of an earth dam with a concrete and clay puddle core-wall, concrete gate house, concrete overflow weir and overflow and inlet channels in rock which embraces about 500,000 cubic yards of embankment, 90,000 cubic yards of concrete, 14,000 cubic yards of paving, 120,000 cubic yards of earth excavation, 65,000 cubic yards of rock excavation, 10,000 cubic yards of clay puddle, 9 3x4-feet and 4x5-feet sluice gates, and other appurtenances.

GENERAL DESCRIPTION.

Wanaque Dam is to be an earth embankment about 1,200 feet in length with a maximum height of about 75 feet, having a concrete and puddle core-wall carried down to rock 100 feet or more below the surface at the deepest point. The up-



GENERAL CONTOUR PLAN OF DAM SITE, SHOWING PAPER MILL INSTALLATION TO BE TEMPORARILY MAINTAINED AND BOUNDARY LINES OF PRESENT AND FUTURE PROPERTY LIMITS.

stream slope of the dam will be protected by a stone pavement and the top and down-stream slopes will be grassed. A masonry overflow weir about 550 feet long founded on solid ledge rock will be built along the hill at the southerly end of the dam. Down-stream from the weir an overflow channel will be excavated in earth and rock to lead the flood water back to the bed of the river below the dam. A gate house will be located at the junction of the earth embankment and overflow weir, which will contain the necessary sluice gates and machinery for drawing water from an open inlet channel formed by an excavated trench and retaining walls into the effluent conduit and for blowing off into the river below the dam. Two diversion dams designated as Midvale dam and Wolf Den dam will be constructed on the rim of the reservoir where shown on the drawings. A substitute highway and driveways will be constructed as shown on the drawings. Sludge from the paper mill and soil will be removed from the dam site and some grading of the grounds below the dam will be done. After April 1, 1921, when ordered, such buildings and structures of the Wanaque River Paper Company, as required on the drawings, shall be demolished and all debris and materials removed.

The axis of the dam intersects at approximately right angles the axis of the Wanaque River, the principal building and the head and tail races and large settling basin of the paper mill, and abuts at both ends on the steep hillsides to which it is anchored by the continuous concrete core wall, 12 feet thick at the base, built in a deep trench excavated in ledge rock to sound material.

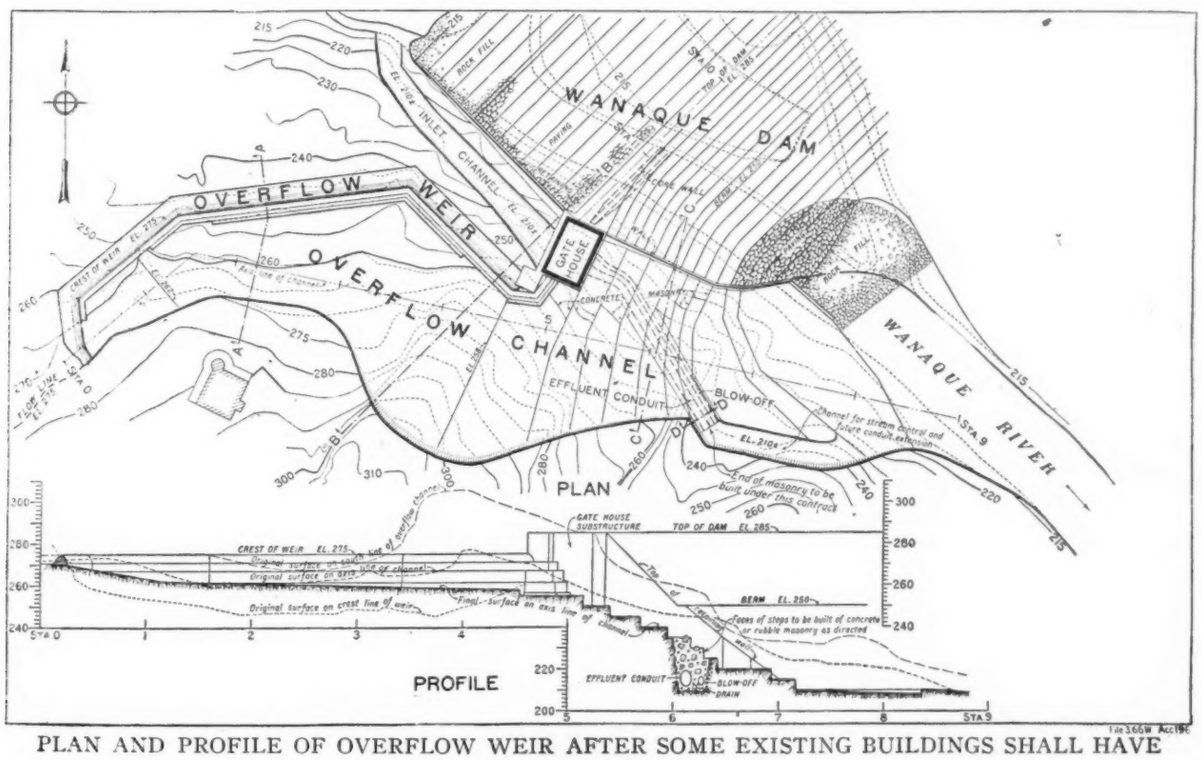
The dam is 15 feet wide on the crest and about 375 feet wide at ground level in the highest place, with side slopes of 1:2, 1:2½ and 1:3. The core wall, 5 feet thick at the top, is battered 20 on 1 on both faces to a maximum distance of 70 feet below the top, below which point the faces are vertical and in the cut-off trench.

The cut-off trench, 22 feet wide at the deepest point, is parallel to and 11½ feet down stream from the dam axis. It is 22 feet wide, lined with steel sheet piles, and concentric with the core wall, the spaces between which and the sheet piling are filled with puddled clay.

The overflow wier, located on the rocky hillside, is a concrete structure continuous with the concrete gate house and core wall construction. It is roughly U-shape in plan, about 520 feet long, 30 feet and 33 feet in maximum height and width. It is built of cyclopean concrete, except the down stream side, which consists of horizontal steps or offsets of rubble masonry.

CONTRACTION JOINTS.

Contraction or slip joints shall be formed where and as directed in the overflow weir, retaining walls and wherever shown on the drawings or required, by building smooth faces, acceptably coated to prevent adhesion with the adjacent masonry. Such joints as required, principally in the overflow weir and gate house, shall have copper strips incorporated therein as indicated on the drawings to form a continuous watertight stop from the bottom of the joint to the top. That part of the copper strip which is embedded in the masonry shall be clean and bright to form a good bond; the remainder shall be coated as required to prevent adhesion. Care shall be taken to protect the copper strips from injury during the construction of the joint.



PLAN AND PROFILE OF OVERFLOW WEIR AFTER SOME EXISTING BUILDINGS SHALL HAVE BEEN REMOVED.

The Specifications.

The specifications are very comprehensive and unusually clear and definite, evidently intended to give the contractor as complete and reliable, useful data as practicable regarding conditions and requirements.

ESPECIAL FEATURES.

Attention of bidders is especially directed to the magnitude of the work and to the contract requirements as to the time of beginning and order of doing the work to meet flood conditions, the temporary occupancy of a part of the site by the Wanaque River Paper Company, the necessity of maintaining a continuous supply of water to the Wanaque River Paper Company and a continuous flow in the Wanaque River, the housing and sanitary regulations and requirements, the early construction of the substitute highway, the rigid requirements of the specifications for securing impervious masonry and embankment and to the difficulties which may be met with in excavating the deep corewall trench and the provisions of the contract whereby there are periodical financial adjustments between the commission and the contractor with respect to payments for labor.

CONSTRUCTION MATERIALS AVAILABLE.

The country in the vicinity of the proposed work has been explored for sand, gravel, stone, clay, and impervious earth for embankments. In order to obtain suitable materials for the upstream impervious embankment and clay puddle, hauls of up to 1½ miles may be required and large quantities of stripping and clearing of the surface will be necessary. Where found, the suitable deposits are in general only from 6 inches to 3 feet in thickness. Sand, gravel and stone appear to be available near the dam site. Most of the sand and gravel will require screening.

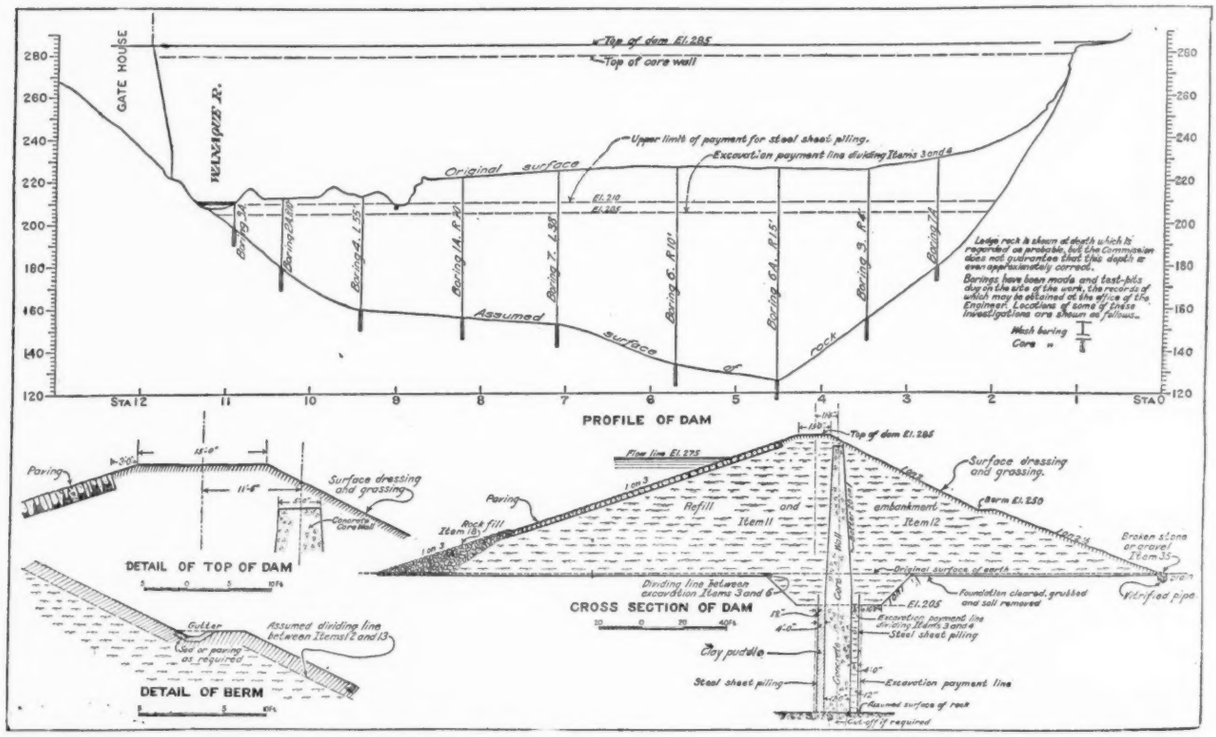
PLANT AND METHODS.

It is the purpose of the commission to build the works under its charge in the shortest time consistent with good construction. To this end, contractors will be required to use improved methods and appliances for doing the various parts of the work. Complete and well-designed construction plants and effective organization will be insisted upon. Special plant and equipment will be needed for removing the thin layers of suitable earth for embankment from over large areas, placing this material in its final position, and for driving the steel sheet piling and excavating the core-wall trench of the dam to ledge-rock.

Before the award of the contract, any bidder may be required to show that he has the necessary facilities, plant, experience, ability and financial resources to perform the work in a satisfactory manner, and within the time stipulated, and that he has had experience in constructing work of the same or similar nature.

RAPID PROSECUTION OF WORK REQUIRED.

The contractor shall commence the work embraced in this contract within 10 days after the service of notice by the engineer on him instructing him to begin work, and shall complete the same in all respects by December 1, 1923, unless delay in awarding contract or delay for any reason, in serving notice by the engineer to begin work shall exceed fifteen days after the date of opening bids. The central portion of the site of the dam will be


Top of dam El. 285
Top of core wall
GATE HOUSE
WANAQUE R.
Original surface
Upper limit of payment for steel sheet piling.
Excavation payment line dividing Items 3 and 4
Assumed surface of rock
Ledge rock is shown at depth which is reported as probable, but the Commission does not guarantee that this depth is even approximately correct.
Borings have been made and test-pits dug on the site of the work, the records of which may be obtained at the office of the Engineer. Locations of some of these investigations are shown as follows.
Wash boring
Core "
STA 12
STA 0
PROFILE OF DAM
Paving
Surface dressing and grassing
DETAIL OF TOP OF DAM
Gutter
Assumed dividing line between Items 12 and 13
Sod or paving as required
DETAIL OF BERM
Rock fill Item 10
Refill and embankment Item 11
Item 12
Broken stone or gravel Item 35
Vitrified pipe
Dividing line between excavation Items 3 and 6
Original surface of earth
Foundation cleared, grubbed and soil removed
Excavation payment line dividing Items 3 and 4
Steel sheet piling
Clay puddle
Excavation payment line
Assumed surface of rock
Cut-off if required
CROSS SECTION OF DAM

GENERAL CROSS-SECTION OF DAM, SHOWING DETAILS OF SLOPE, PROTECTION AND CORE-WALL. LONGITUDINAL PROFILE DIAGRAM, WITH LOCATION OF PRELIMINARY EXPLORATION ROCK BORINGS.

occupied by the Wanaque River Paper Company until April 1, 1921, and the contractor will be required to complete before this date the excavations in connection with the inlet channel, overflow channel, overflow wier, gate house and that part of the core-wall trench not located on the lands reserved for the Wanaque River Paper Company, and the construction of the core-wall at least up to the original surface of the ground within these limits and the overflow weir except a section to be left open for flood control to be designated by the engineer. Unless otherwise ordered the Midvale dam shall not be built until the highway which crosses its site has been closed.

The time in which this contract and each part thereof is to be performed and the work thereunder is to be completed is of the essence of this agreement.

If the engineer considers it necessary the contractor must prosecute the work by night as well as by day, but shall receive no extra compensation therefor.

MAINTENANCE OF PAPER MILL ON DAM SITE.

While the Wanaque River Paper Company continues to occupy its present location, on the dam site, until April 1, 1921, the contractor shall not interfere with, nor foul the water in the head race, nor obstruct the flow in the tail race except as required. Except as otherwise required, an uninterrupted full supply of water at maximum levels shall be maintained in the head race until April 1, 1921.

ACCEPTABLE RIVER CONTROL AND CONSTRUCTION SCHEDULE.

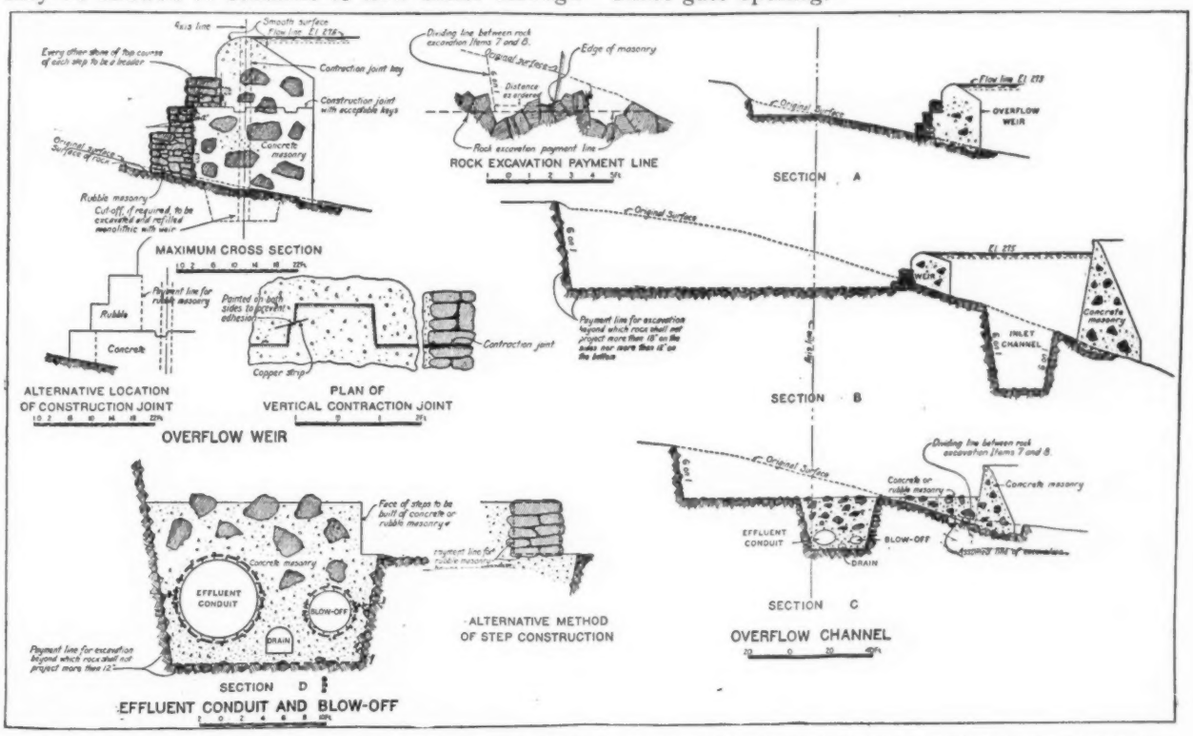
During the year 1920 and up to April 1, 1921, the ordinary and flood flows of the Wanaque River may be allowed to continue to flow either through the existing river bed or through the tail race, the flow being shifted to the tail race while building the core-wall under the river up to the level of the river bottom. Immediately after April 1, 1921, the stream-flow through the tail race shall be discontinued, in order that the core-wall trench through the paper mill site may be started, and the stream-flow will be limited to the original river bed.

Before the stream-flow may again be diverted from the river bed a new channel shall be provided through the inlet channel and effluent conduit trench and the contractor shall excavate the inlet channel and the effluent conduit trench and lay the foundations of the gate house before closing the river bed for a second time.

When all of the core-wall except that across the river bed has been completed to at least elevation 240 and the down-stream embankment to at least elevation 225 the old river bed may be closed and the stream-flow turned into the inlet channel, after which the dam in the river bed may be carried up to elevation 235, no earth being deposited on the down-stream side until the core-wall has reached elevation 225.

Meanwhile the work on the remainder of the dam shall be continued but the part south of Station 10 + 75 shall be continuously maintained at an elevation at least 5 feet below the other portions of the dam in order to provide for the passage of any floods which might exceed the capacity of the inlet channel.

When the embankment and core-wall have been built up to elevation 245 the construction of the gate chamber may be begun. The northerly portion of the gate chamber site may be dammed off and a part of the chamber constructed up to above the lower sluice gate opening.



DETAILS OF OVERFLOW WEIR AND CHANNELS, SHOWING ROCK SLOPES, CONCRETE JOINTS, AND RUBBLE MASONRY FACING.

After this portion has set, and when ordered, the temporory dam shall be entirely removed, the stream-flow turned through the completed openings and conduits and the remainder of the channel dammed off and the remaining lower portion of the gate house completed. The temporary dam shall then be entirely removed and the stream-flow allowed to pass through all the openings.

At this stage of the work floods will flow over the top of the masonry of the partially completed gate house but the ordinary flow may be controlled through the openings so as to permit the completion of the gate house superstructure, effluent conduit, blow-off, and drain. The masonry of the gate house shall be kept at least 25 feet below the lowest point of completed dam until the core-wall at its lowest point has reached elevation 265, at which time the gate house may be completed. The closure of the river bed and the construction of the lower portion of the gate house shall be done during a season of low stream flow.

SHEETING CORE WALL TRENCH.

The steel sheet piling shall be driven to a firm, tight bearing on the rock before excavating the trench below elevation 205. To insure accuracy in driving, the steel sheet piling shall be assembled and interlocked in a continuous vertical wall surrounding separate sections of approved size, into which the trench will be divided, not less than 50 piles being assembled in the wall as a unit for driving. These walls of piling shall be placed against and rigidly and accurately held in place by timber guide wales, one placed at the ground level and a second at a height above it not less than 1-3 the length of the shortest pile in the unit to be driven, each wale to be supported by a timber framework. When the wall has been driven to a sufficient depth to be firmly held by the ground the wales may be taken down or moved ahead and used again.

The steel sheet piles shall be driven by a steam or air pile driving hammer set centrally over them and held securely and vertically so that each blow shall be directed along centre of gravity of the piles. If required a driving head of cast-iron or steel shall be used on the top of the piles to prevent burring. All parts of the assembled wall shall be carried down as nearly simultaneously as is practicable, the cutting edge of any pile not being permitted to penetrate more than 5 feet deeper than the bottom of an adjacent pile.

Any boulder encountered which is large enough to prevent further progress by driving, shall be displaced by forcing water around it in large quantities under high pressure, through a 2½ inch casing sunk to the boulder by the wash or water-jet method, or if this fails blasting may be resorted to, using this casing as a means of placing explosives, or such other means as may be approved. Before firing any explosives all adjacent piles shall be withdrawn to a safe distance to prevent bending or injury to the cutting edge.

RESERVE SUPPLIES.

The contractor shall have at the site of the work at all times duplicates, in good condition, of such machines or parts of machines or appliances as are especially likely to wear rapidly, break, or be lost, so that the time lost on account of any part of the plant being out of order may be reduced to a minimum. For this purpose also he will be required to establish one or more suitable repair shops, at or very near the site of the work.

PUMPING AND WATER SUPPLY.

As very deep excavation will be required for the core-wall trench where water is likely to be encountered and as there may be considerable overflow, and seepage from the river, which it is estimated may amount to 75,000 million gallons raised 1 foot, the contractor shall provide equipment for the removal and disposal of water from the excavations and other parts of the work, and for the removal of sufficient ground water adjacent to the excavation to assure the stability of the slopes.

For all plant, labor and materials connected with the removal of water from the core-wall and dam excavation and for pumping during the construction of the core-wall and dam and its appurtenances, the contractor shall receive the stipulated price per million gallons raised one foot. The measurement of head pumped against shall not include friction losses in pumps or piping, nor losses due to pumping in two stages, but the head shall be measured from a reasonable level in the sump from which pump or pumps engaged in exhausting the water in question takes its water to a reasonable elevation of the final discharge point.

PLANT WATER SUPPLY.

The contractor shall also provide at convenient points ample supplies of water of proper quality for all the operations required under this contract. This shall include the furnishing of pure water in acceptable quantities to the office of the engineer. A proper piping system shall be installed, maintained and extended from time to time to distribute water to the various portions of the work where it is needed. Wherever necessary the water shall be under sufficient pressure to give an effective stream from a nozzle for cleaning ledge rock or masonry on which masonry is to be built, for washing stones to be used in masonry, for sprinkling masonry, for wetting embankments, and for other purposes.

For fire protection of all the important temporary and permanent structures a water system shall be provided which will maintain a base-nozzle-pressure of 70 pounds when two 1⅛-inch fire nozzles are each discharging 200 gallons per minute. Hose connections and hose shall also be provided for fighting fires in these structures, and responsible persons shall be instructed as to the operation of such fire apparatus, so as to prevent or minimize loss of time from fire. Water casks or extinguishers of approved type shall be provided for minor structures.

SANITARY REQUIREMENTS.

Sanitary plumbing and approved methods of heating shall be installed. Rooms shall be acceptably ventilated and furnish complete protection from the weather. Single sleeping rooms shall be not less than 8 feet by 10 feet by 9 feet in size and all rooms shall have an adequate volume of air. All houses occupied by employes shall be thoroughly

screened to exclude mosquitoes and flies. Cantonments shall, if ordered, be enclosed by satisfactory man-proof fences, with not more than two entrances. The entire ground within the limits of the various camps shall be thoroughly illuminated by electric arc lamps or other acceptable lights. This illumination shall be maintained from sundown to sunrise every night during the occupation of the camp, unless otherwise ordered.

Buildings for the sanitary necessities of all persons employed on the work, beginning with the first men employed to build camps or for other preliminary operations, shall be constructed and maintained without nuisance. The requirement for sanitaries in any locality shall be on a basis of one seat for each 20 persons, including both those on duty and those in camp off duty, who are dependent on the sanitaries in the locality in question; and they shall always be reasonably near the work. Sanitary conveniences shall be of the incinerator, water carriage, can or latrine type. The incinerator or tight-can type will be required within the watershed tributary to the reservoir. Where incinerators are required they shall be sufficient in number in any locality to permit a reasonable proportion to be out of service for incineration of their contents daily. Where the can system is permitted, cans shall be hauled away at least once a day and empty cans substituted therefor. No cans shall be emptied within the watershed. If latrines are permitted they shall be in accordance with the best practice in field sanitation and shall be burned out daily with crude oil. Drainage from kitchens, laundries, sinks, stables and other camp buildings, and any sewage, shall be satisfactorily collected and treated before discharge into any stream.

The contractor shall supply corrosive sublimate, quicklime, chlorinated lime, sulphur and other disinfectants and fumigants in ordered quantities, and perform the labor necessary to apply these materials as directed in disinfecting and fumigating camp and other buildings and disinfecting stables or grounds.

GARBAGE DISPOSAL.

Garbage, both liquid and solid, shall be promptly and satisfactorily removed from the buildings and immediately placed in approved tight receptacles of sufficient capacity for about one day's ordinary production. At least once in every twenty-four hours all such garbage shall be incinerated or otherwise thoroughly and satisfactorily disposed of.

The use of animals, except where especially permitted, will be forbidden within the reservoir wherever it is practicable to employ railroads, traction engines, cableways, power excavators or other mechanical devices to do the same work. Manure will not be permitted to accumulate anywhere.

MEDICAL AND SURGICAL PROVISIONS.

The contractor shall retain the services of an acceptable, qualified medical and surgical practitioner who shall have the supervision of the health of his employees, shall inspect their dwellings, the stables and the sanitaries as often as required, and shall supply medical attendance and medicine to the employees whenever needed.

The contractor shall provide ample general hospital buildings, supplies, facilities and attendance and must also provide the same for an isolation hospital for communicable diseases. All applicants for employment of the dam must pass a physical and medical examination and be free from any communicable disease.

CLASSIFICATION OF EARTH EXCAVATION.

Item 3 shall include all earth excavation, including top-soil and paper-mill sludge whether or not removed in advance of the other excavation, for the core-wall of the dam above elevation 205. Item 3 shall also include excavations for the core-wall of the dam ordered to be made below elevation 205 with unsupported side slopes flatter than 6 vertical on 1 horizontal.

Item 4 shall include all earth excavation for the core-wall of the dam in trenches with sides steeper than 6 vertical on 1 horizontal between the bottom of the excavations classified under Item 3 and elevation 150.

Item 5 shall include all earth excavation for the core-wall of the dam in trenches with sides steeper than 6 vertical on 1 horizontal, below elevation 150.

Item 6 shall include the removal of top-soil and paper-mill sludge not include in Item 3, and all earth excavations for the Midvale and Wolf Den dams, gate house, overflow weir, overflow and inlet channels, effluent conduit trench, substitute highway, driveways, fence, grading below the dam, and for all other purposes not included in Items 3, 4 and 5. Items 3, 4, 5 and 6 shall not include excavation from borrow pits, but the excavation of all such material will be paid for only under refill and embankment, Items 11 or 12 as classified.

The quantities to be paid for under Items 3 to 6 inclusive shall be the number of cubic yards of material measured as before excavation. All trenches in earth required to have approximately vertical sides not flatter than 6 vertical on 1 horizontal shall be measured as having vertical sides and the designated bottom widths.

In sheeted trenches with sides steeper than 6 vertical on 1 horizontal the bottom widths designated for payment will include an allowance as shown on the drawings of not more than 1 foot on each side of the net required space for structures or forms. All excavations in earth required to have side slopes flatter than 6 vertical on 1 horizontal shall be measured as having side slopes of 1 vertical on 1 horizontal unless flatter slopes are ordered; if flatter slopes are ordered, the excavations shall be measured in excavation to include the quantities actually removed from within the limits required.

FINANCIAL PROVISIONS.

The contractor shall give a bond in the full amount of the contract price. He shall pay to the Commission all expenses, loss and damages as determined by the Engineer, incurred in consequence of any defect, omission or mistake of the Contractor or his employees and shall pay as liquidated damages the sum of $250 per day for each and every day, except Sundays and legal holidays, that he shall be in default in completing the entire work to be done under this contract after November 30, 1923.

A bonus of $250 per day will be paid for each

day, except Sundays and legal holidays, said contract is completed prior to December 1, 1923, it being understood and agreed, however, that a bonus will not be paid for more than a total of fifty days.

In addition to the liquidated damages herein provided for, there will be deducted from the moneys due under the contract, the wages, if any, paid to any inspector or inspectors necessarily employed in such work by the Commission for the number of days in excess of the time stated for the completion of the work.

Excavation With Power Scraper

The use of a slip scraper hauled and dumped by a simple, portable, power equipment and operated by two men saved $50 a day on the excavation for a large factory building.

The earth excavation for the Milwaukee Glove Works Company's factory at 10th and National avenues, Milwaukee, involved the removal of a large quantity of earth from street level to a few feet below, which was rapidly and satisfactorily excavated and loaded into wagons without hand labor. This was accomplished by the use of a hauling and elevating apparatus that was easily shifted from point to point, commanding the entire area of the excavation and elevating the spoil high enough to dump directly into motor trucks in the street, thus avoiding the necessity of having the trucks enter the pit and climb out again on a steep inclination, thereby considerably increasing their capacity and the rapidity of operations. The excavating and elevating of the earth was practically a continuous operation, except that it was limited by the ability of the trucks to remove the spoil as fast as provided, thus involving working time not due to any fault of the excavating apparatus.

POWER MACHINE.

An excavator and loader machine manufactured by the T. L. Company, and consisting essentially of an inclined steel frame plane about 25 feet long mounted with a hoisting engine on a truck, was installed with the rear end on the curb line and the upper part of the incline cantilevering over and clear of the top of a five-tone motor truck. The steel cable from the drum of its 18 h. p. heavy duty gas hoisting engine passed over a sheave at the upper end of the inclined plane, and over a second sheave mounted on a revolving frame pivoted to the inclined plane near the center point and normally perpendicular to it.

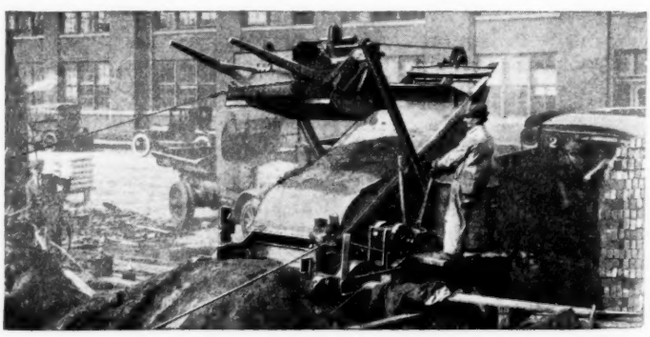
The cable was attached to the front of an ordinary slip scraper operated by one man. To the rear of the scraper was attached a tail line led through two sheaves attached at different points to an anchor chain fastened at the ends to steel stakes driven in the ground in such a position that the direction of the chain was approximately perpendicular to that of the hauling line. From the second

HAULING FILLED SCRAPER TO INCLINE AT SPEED OF 206 FEET PER MINUTE.

sheave the tail line was led directly to the drum of the hoisting engine.

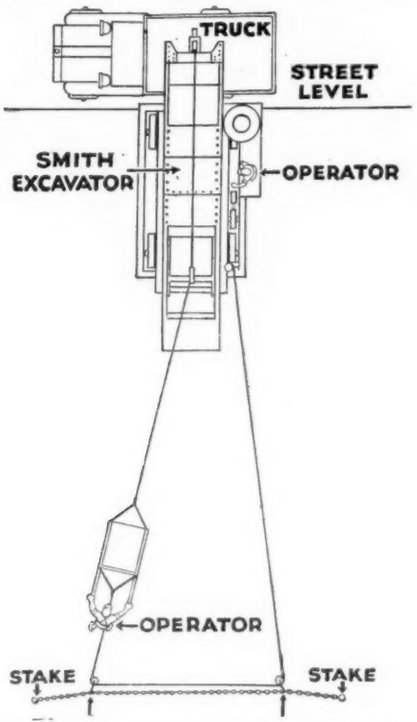
EXCAVATING AND LOADING.

The tail line pulled the scraper backward to the required position for excavating at a sped of 228 feet per minute, and the hauling line pulled it forward at an excavating speed of 106 feet per minute. When the filled scraper, hauled at a speed of 106 feet per minute, reached the inclined plane, it was continuously pulled up on it, ascending smoothly on the sheet iron apron to a point where there was a hump in the apron under the pivoted frame, and the latter was automatically unlocked by the scraper so that the continued tension on the hauling line revolved the frame upwards, elevating the scraper above the plane and carrying it forward to the end of the cantilever, where it was automatically reversed, dumping its contents into the waiting trucks. The machine operator then pulled the reverse lever, causing the pivoted frame to swing back and down and lock, and the tail line to haul the scraper back

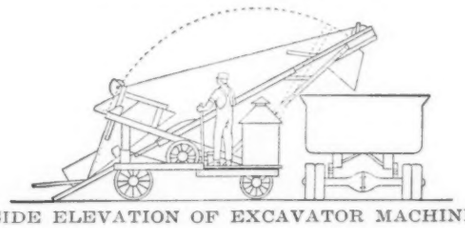


PIVOTED FRAME RAISING SCRAPER TO DUMPING POSITION.

to excavating position at a speed of 228 feet per minute. Only two men were required to operate the scraper and load the trucks. Whenever it was necessary to shift the point of excavation, the forward tail line sheave was very quickly reconnected to the anchor chain at a different point, and, when the full area commanded by the length of the anchor chain was excavated, it was very easy to drive the stakes in new positions and shift the chain for continued operations.



ARRANGEMENT OF EXCAVATOR OPERATING LINES, SCRAPER AND ANCHOR LINE.



SIDE ELEVATION OF EXCAVATOR MACHINE.

Although the spoil was hauled a long distance from the factory there were only two trucks available for the work. Each of these was loaded in about six minutes, after which there was a wait of 15 to 20 minutes for the next truck, but even under these circumstances the excavation averaged 150 yards per eight-hour day, and the contractor, Gerry Wolf, made an estimated saving of $50 per day over the cost of doing the work without the excavating machine.

Railway Freight Movement

In the United States there are about 2,452,000 freight cars now in use. These are rolling in trains loaded and empty only 9.03 per cent of the time. They average 11.29 per cent time loading and 11.29 per cent being unloaded, if every car is released before demurrage starts. The balance of 68.39 per cent is waste time, due to repairs, switching, and unnecessary delays. One hour saved each day for each car would be 2,452,000 car-hours per day, equivalent to over 102,000 additional cars at no delay or extra cost.

March Building Operations

The total amount of contracts awarded during March in the territory east of the Missouri and north of the Ohio rivers, according to statistics compiled by the F. W. Dodge Company, showed a great increase over the figures for January and February, and was, in fact, greater than the figure for any month in 1919. The total amount for March was $327,897,000, as against $235,848,000 for January, and $216,663,000 for February

These figures give $780,408.000 as the total for the first quarter of 1920. Normally the first three months of the year account for about 20% of the year's total of work started. In the first quarter of 1919 contracts awarded amounted to $275,555,000. Of the total for the first three months of the year, $267,193,000, or 34%, was for industrial buildings; $150,651,000, or 19%, was for residential buildings; and $146,973,000, or 19%, for public works and utilities. This shows that the work which has been held up is in the residential group; that is, the smaller building operations. Normally, this group accounts for about 30% of the total, and at the present time, in view of existing needs, it should be about 40% of the total.

Although contracts have been awarded to the amount of 780 millions of dollars there is still a vast amount of work being held up for more favorable conditions. In the first quarter of 1920 contemplated and projected work of all kinds was reported by the F. W. Dodge Company to the amount of $1,700,000,000. Of the contemplated work, public work and utilities amount to $363,802,000 or 21% of the total; industrial buildings amount to $355,073,000, or 21% of the total; and residential buildings amount to $343,173,000, or 20% of the total.

Omaha Municipal Gas Plant

Omaha, Nebraska, which has a population of 200,000, is the largest municipality in this country to undertake the operation of a gas plant. On March 20, the city commissioners voted to take over the works of the private gas company at a price of $4,500,000 and to operate them; further voting $1,000,000 as working capital for improvements and extensions.

In November, 1907, the city voted at a special election against issuing $3,500,000 in bonds for acquiring the gas plant. In May, 1918, however, the proposition to acquire the gas plant by eminent domain through the Condemnation Court was carried and an appraisal of the plant was made by Burns & McDonnell representing the city and by W. H. Taylor, H. C. Anderson and William A. Baehr representing the company. The value placed upon

the property by the city's appraisers was $3,760,000, while the three appraisals made for the company varied from $5,518,000 to $6,281,000. These figures were intended to represent the depreciated value of the property, including going value. Early in February, 1920, the Condemnation Court rendered a decision fixing $4,500,000 as the value of the property and the action of the city commissioners was taken upon the basis of this award.

The plant will be operated by the municipality under a bi-partisan board of directors with a manager in charge of the property, the board being the same that now so successfully operates the municipal water plant. It is not anticipated that gas rates will be increased under city management, although such rates have been increased by many of the privately owned gas plants throughout the country.

Cost of Unimproved Roads

In a recent letter written by S. M. Williams, chairman, Federal Highway Council, the statement is made that in this country the waste due to unimproved roads is more than $500,00,000 per year, a sum which conclusively demonstrates the immediate necessity of highways on which heavier loads can be hauled for longer distances, at greater speed and with reduced power than is now possible.

It is estimated that the time wasted on account of difficult highway hauling due to poor roads is equal to that of an army of 250,000 men who should be released for active work on increased production. He also points out that improvement of the 85 per cent. of traffic that is carried on public highways is fully as important as that on the 15 per cent. carried by railroads. Such a program in no way interferes with one of thorough economy, the latter consisting not in the spending of no money, but in spending money most efficiently.

A graphic illustration of the high cost of bad roads has recently been cited in the case of a farmer in Sullivan County, Tennessee, who had to make four three-day trips with a two horse team to haul a ton of barbed wire 23 miles at a total cost of about $36.00. After a hard road had been built he was able to haul one ton in two days at a cost of $6.00 allowing $3.00 per day for the team and driver, a sum which would have to be considerably increased today, thus making the saving proportionately larger.

Highway Notes

The Galveston, Texas, Board of Engineers has completed its survey and submitted a report recommending the expenditure of $6,750,000 for 11,000,000 yards of filling, for repaving, minor contingencies and engineering, $628,000 for extensions of present sea-wall, $175,000 for the construction of higher new sea-wall, $9,500,000 for raising the grade of all railroads and freight handling plants and other improvements.

Good roads has been made a plank in the political platform of Cameron Morrison, candidate for governor of North Carolina. He declares himself "In favor of a robust good road policy—which will result in the speedy construction of a great system of highways worthy of North Carolina." He proposes to link together a dozen isolated counties in the northwest part of the state that comprise one of the richest and greatest sections of the state to the railroad system.

It is reported to have been seriously proposed to solve the London traffic problem by a great subterranean system of motor thoroughfares, including boulevards, to connect the heart of the city, 30 miles wide, with the outer districts and permit automobiles to escape the congestion of the other vehicular traffic. Such an idea seems to be working backwards from the plan of providing freight subways under the streets, as has been accomplished with some success in Chicago.

Iowa Highway Program

In the state of Iowa about 1,200 miles of new roads have been surveyed and plans and specifications completed and approved. The mileage includes 321 miles of paving and 207 miles of gravel, the balance being earth road grading. In addition, there are now under way contracts for 231 miles of road and 26 counties have voted for hard surfacing and 13 counties have voted against it. The total amount now available for road construction in the state is about $33,000,000 and the immediate problem is to get material, contractors and labor to execute the work.

Wanted, An Altruistic Contractor

In Douglas County, Nebraska, litigation is expected because bonds for county highways were voted on the strength of a pledge by the County Board that the roads would be surfaced with brick, notwithstanding which less than one-third of the contracts already let call for brick construction.

A strong appeal has been made against the substitution of bithulithic compounds for vitrified brick and the matter will probably be litigated unless the innocent contractor, who was low bidder on both the brick and bitulithic pavements, will give up the bitulithic contract and pocket the loss for the benefit of the public.

To Diminish Tearing Up Pavement

The recent decision of a court in Cincinnati, establishes a precedent for all Ohio municipalities to force taxpayers and corporations to put all necessary improvement on the streets before the latter are repaved, and if they refuse to do so, authorizing the city to make the improvements and charge the cost of the same back to the taxpayers or corporations. The case will be appealed and is expected that the final decision of the Supreme Court will be handed down promptly.

The new paving now in progress or already ordered for Fort Worth, Texas, totals $2,500,000 and even with plenty of labor and materials, cannot be completed within less than one year making it is claimed, the best paved city in the southwest.

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Just and Acceptable Construction Requirements

The Wanaque Dam described in this issue is a fair example of important public work involving ordinary features of heavy construction similar to those likely to be encountered almost anywhere in this country on municipal goverment, or corporation projects of magnitude. In preparing these admirable specifications and contracts, which are partially excerpted in our article, the chief engineer, M. R. Sherrerd has revised and improved some of the best specifications of the kind previously issued and has added to them clauses well calculated to define the important requisites for a first-class job, making them simple enough to be easily understood and followed, and avoiding the necessity of interpretations and providing fair treatment and consideration for the contractor without in any way impairing the excellence of the work required or neglecting the interest of the owner.

Special pains have been taken to determine obscure conditions and probabilities and to foresee difficulties and resources that may be developed during the work so that the contractor can plan to the best advantage, although still acting wholly on his own responsibility, aided by the intelligent preliminary investigations of the designer.

By incorporating in the contract definite requirements regarding labor, housing, sanitary and medical conditions all bidders are compelled to conform to high-class practice, and the interest of the state, of the laborer and of the owner are protected without deteriment to the contractor.

Special attention is called to unusual features and requirements of the work by a note emphasizing the importance of the core-wall trench, the river regulation, the schedule of operations to secure rapid progress and the unusual features of waterproofing and price adjustment.

The rational classification of earth excavation in items defined by the working conditions, as well as by the character of the material, enables a fair price to both the owner and contractor to be secured for each unit. This price is accurately defined, and is directly proportioned to the actual cost of the work, and shows consideration for the contractor, who, although unable to make a great unearned profit, is protected by it against losses due to great variations of anticipated quantities.

The customary penalty for delayed completion of the work is, as it always should be, offset by an equal bonus for earlier completion, which is fair to both parties.

The unusual provision of a unit price for pumping out foundation pits during construction is justified by the exceptional depth and expected condition of the core-wall trench that would otherwise compel the contractor to bid unreasonably high to protect himself.

The tentative requirement that the bidder shall possess experience, equipment and finances adequate to the work is just and reasonable, and should certainly be enforced in this and all other similar work of magnitude and difficulty.

A very important feature of the specifications is the provision for varying the price to the contractor in accordance with large variations in the cost of labor, which is such an important factor of the work that, in these times of great instability, it would probably deter conservative contractors from bidding except on a cost-plus basis or at prohibitively high figures. Contractors will appreciate these specifications and the spirit in which they are prepared, and they should go far to improve the quality, rapidity, and economy of the work.

Improving Labor Conditions

Increase the efficiency of labor by classification, selection and training. Fight to a finish for open shops. Discharge worthless and seditious employees at the drop of the hat. Make labor unions incorporate, provide and enforce heavy legal and criminal penalties for breach of contract, violence, intimidation and conspiracy. Simplify construction plans, adopt standard plant and methods, work to pre-determined schedules, use materials suited to practical requirements, not necessarily superfine, use the maximum of high-class labor saving machinery. Then, and not before, will this land be honest, safe and prosperous.

Poor Policy and Precedent

The announcement that the Erie and Oswego canals are to be operated on a schedule of only 8 hours per day, indicates either that they have far too little traffic, that they are governed by a deplorably parsimonious policy or that they are being handled for political effect, a trio of evils which is hard to choose between.

In this time of high freight tariff and congested transportation, the canals ought to be operated to the limit of their capacity, and at all times their service during the short navigation season, in this case only from May 1 to Nov. 1 should be continuous especially since it is of a nature very slightly affected by day or night conditions. If with a moderate amount of business eight hours of traffic paid the charges, the other sixteen hours would be pure velvet on the investment, so that eliminating them is the worst kind of penny-wise, pound-foolish policy provided there is or can be secured sufficient traffic for continuous service.

On the other hand, if revenue is limited or traffic in any way discouraged to serve political ends or at the behest of labor unions or any kind of profiteering influences, it is especially corrupt.

The only excuse for part-time work on this valuable property is the impossibility of getting sufficient business and if that be the case, it should apparently be quickly remedied.

Especially at the present time when increased production and economy are vital necessities, the operation at part-time of any important industrial or commercial system than can or should be operated continuously, is both foolish and wrong. The fact that it is a public utility controlled by public officers and superior to limitations and restrictions of private enterprise makes mismanagement wholly unnecessary and the example that it affords of inefficiency, wastefulness, and injustice encourages the conscienceless wastrels, profiteers and the turbulent and irresponsible elements of Bolsheviks, Socialist and Communist tendencies.

It is therefore doubly regrettable both for policy and precedent to have any failure of the most abundant, efficient, and economical service that public utilities are capable of, especially in transportation.

Uniformity for Concrete Sewers

A desirable step for the improvement of type, details, materials and construction of concrete sewers, has been taken by the American Concrete Institute in presenting through its committee of experts a standard specification for the construction of concrete sewers, accompanied by rules recommended for their design, the latter being published in full on page 336. These standards are especially acceptable for their simplicity and brevity. They do not attempt unnecessary refinement; they are admirable not only for the clear and positive restrictions in vital points where there can be no conflict of opinion on the practice involved, but also for the brief and authoritative rules that do not require demonstration or explanation. They possess at least an equal virtue in the omission of special cases, elaborate conditions, irregular work, complicated details, minor variations and exceptions that so often burden efforts to accomplish the impossible in providing for every sort of contingency and specifically covering an unknown field.

These rules simply indicate the more important general considerations that are applicable to all concrete sewer construction and which, if adopted, will lead to a much greater simplicity and uniformity, making design, estimates and construction more rapid, satisfactory and efficient, and will tend to eliminate disputes and misunderstandings between owners, engineers and contractors and to generally improve current practice.

These rules apply chiefly to the regular cross-section of the sewer under ordinary, normal conditions, and are not involved with special requirements, conditions or difficulties that, to be successfully met, must always be carefully studied and supervised by experienced engineers.

The rules do not in any manner make "Every man his own engineer" but they do afford safe minimum provisions that establish standards which may be confidently adopted for ordinary work and accepted in cases of quick decision where there is little time for investigation, with the strong probability that, even if there may be slight excesses over the absolutely necessary requirements, the uniformity and simplicity will justify them and result in total costs about as low as or lower than would be secured by hair-splitting refinements.

The rules govern the principal dimensions of the structures, proportions of concrete and reinforcement, maximum working stresses in concrete and steel, calculation of stresses by standard method, and the finish of the invert; data which, with the specifications themselves, provide for durable and reliable construction.

It is be regretted that the brevity of the rules has prevented their including more reference to foundations in very soft, wet or treacherous ground and protection against exterior forces, as at road crossings.

Municipal Bond Sales

In March of last year the output of new bonds was $57,000,000 as compared with $21,000,000 and $24,000,000 in January and February, respectively, and with $26,000,000 in March of 1918. In March of this year, the sale dropped to less than $51,000,000, which, however, is considerably higher than any year since 1915, with the exception of last year. The falling off is more evident, however, when compared with the $87,000,000 in January, 1920, and $89,000,000 in December, 1919.

According to the Bond Buyer, "the best cities in the country are now having trouble in financing improvements with five per cent bonds, whereas, a year ago that rate of interest was sufficient to assure the sale of any reasonable amount of bonds at a substantial premium. While most cities are permitted by law to pay as high as 6 per cent, such a rate is so unusual that the tendency is to postpone the making of improvements and the issuance of bonds when it is found that the market demands over 5 per cent." In fact, we have learned of at least one city which has so far been unable to dispose of 6 per cent bonds at par and is postponing work in consequence.

To a considerable extent, this will have a much less effect upon state and county highway work than upon city work, for the reason that there is already available a large amount of funds for such work, and in most of the states the income derived from automobiles is available for highway construction. It seems probable, therefore, that road work will be little interfered with by bond market conditions, but will be limited by the high cost and scarcity of materials and labor and difficulties in transportation.

Bending Reinforcement Bars

A large quantity of ⅝-inch twisted reinforcement bars for a syphon near Caldwell, Idaho, were rapidly and economically bent by an ordinary tire bender with the rolls set vertical and operated by power from the concrete mixer. Two or three bars could be bent simultaneously, six or eight being bent per minute.

Concrete Sewer Standard Specifications

The Committee on Concrete Sewers, appointed by the American Concrete Institute, presented at the 1920 convention a report submitting standard specifications for the construction of concrete pipe, arch and slab sewers (to be excerpted in "Public Works"), and recommended that the sewers would be designed in accordance with following standards. Comprehensive and detailed requirements proposed for adoption as standard include features commonly used in advanced structure practice and give special attention to invert construction; arch forms; backfilling; manufacture, testing and laying of reinforced concrete pipe; and comprehensive rules for concrete sewer design.

COMMITTEE'S REPORT.

The American Concrete Institute's Committee on Concrete Sewers recommended to the Chicago Convention, February 16-18, the adoption as standard of specifications for construction and design which are in revision of those submitted by the committee at the 1919 meeting.

As instructed by the last meeting, the committee has, as far as possible, eliminated the word "Contractor" from these specifications. If this matter had not come as an instruction from the meeting, it appears that the committee should have preferred to have retained the so-called contract clauses, as in many cases they seem to be almost integral parts of necessary specifications. The committee does not, however, consider their inclusion as of vital importance.

The committee accepted the amendments as to speed of mixers which were made on the floor of the 1919 meeting, but voiced a feeling that standard mixer speeds can be somewhat slowed down with resultant advantage to the product.

The committee does not concur in the amendment from the floor of the 1919 meeting introducing blast furnace slag as a good coarse aggregate. This material is, however, included in the accompanying specifications, and is to be considered as having been included by the 1919 meeting without the approval of the committee. The committee has no data on which to approve or disapprove of this material in sewer construction.

In the matter of quality of crushed stone aggregate, the committee substituted a French coefficient of wear of 8 for the coefficient of hardness of 16 formerly recommended. This will not materially change the character of stone permitted, but the change is made in order to eliminate the recollection of the discussion on the floor of the 1919 meeting, in which many of the members apparently mistook the coefficient of hardness for the French coefficient of wear.

The French coefficient of wear is fully described in bulletins 347 and 370 of the United States Department of Agriculture, and the test on which it is based has been standardized by the American Society for Testing Materials. The committee consisted of W. W. Horner (chairman), Arthur S. Bent, Alfred H. Hartman, W. S. Lea, Frank A. Marston, Langdon Pearse, Coleman Meriwether, W. R. Harris, A. J. R. Curtis and W. K. Hatt.

Rules for Concrete Sewer Design

1. Concrete sewers without reinforcement are approved for sizes between 30 and 60 inches mean diameter. Plain concrete sewers between these sizes are to be used only in rock or hard soils. It is recommended that the minimum thickness for a diameter of 36 inches or under should be 5 inches, and for a 5-foot diameter 7 inches, with intermediate sizes in proportion. These thicknesses are to be taken as a minimum for circular sewers and used only under favorable conditions.

CONCRETE PIPE SEWERS.

2. (a) Steel Reinforcement.—The reinforcement for circular pipe shall consist of one or two rings of steel wire fabric or rods of the areas shown in the accompanying table. Special methods of reinforcement will be permitted if the requirements of Article 7 as to crushing strength are fulfilled.

(b) Thickness.—The thickness of pipe walls shall be as set forth in the following table, but thinner walls may be used provided the amount of steel reinforcement is increased to give sufficient strength to withstand the crushing loads specified in Article 7 of these specifications.

REINFORCED CONCRETE MONOLITHIC SEWERS.

3. All sewers near the surface and subject to moving loads or vibration should be reinforced. For sewers of 6 feet or less in diameter it is recommended that the reinforcement be half of 1 per

cent placed near the inside at the crown, and near the outside at the springing lines.

If it appears at all possible that the horizontal pressures on the sewer might be large, reinforce for reverse stresses.

4. It is recommended that for all sewers greater than 6 feet in diameter several possible types of loading be assumed and stresses be calculated on the elastic arch theory. (The methods are indicated in Tourneaure and Maurer's "Principles of Reinforced Concrete," or in Metcalf and Eddy's "American Sewerage Practice," Volume 1.)

5. It is also suggested that in sewers of greater than 6 feet in diameter it may be found economical to adopt a section having a comparatively flat bottom and an arch with or without intermediate side walls.

6. The minimum thickness of concrete in sections of this type should be 8 inches. This is recommended as a factor of safety against poor placing and also to secure waterproof structures.

DIMENSIONS AND REINFOREMENT FOR CIRCULAR SEWERS.

Size, inches.	Minimum Thickness of Shell, inches.	Cross Sectional Area of Steel, lin. ft. of Shell.
24	3	1 concentric ring of .058
27	3	" " " " .068
30	3½	" " " " .080
33	4	" " " " .107
36	4	" " " " .146
39	4	" " " " .146
42	4½	" " " " .153
48	5	2 " rings " .107
54	5½	" " " " .126
60	6	" " " " .146
66	6½	" " " " .168
72	7	" " " " .180
84	8	" " " " .208
96	9	" " " " .245

PROPORTIONS OF CONCRETE.

7. The specifications submitted provide for three classes of concrete. It is recommended that all arches be built of Class "A"* concrete, and that the inverts be of Class "A" concrete, except in rock or very hard soils, where Class "B" concrete may be used. Class "B" concrete is not recommended for use in the sewer proper.

8. For reinforced work in bad ground the designer should provide for a raft of Class "C" concrete of from 4 to 6 inches in depth, which is to be allowed to set before the reinforced structure is started. This is advisable to facilitate good workmanship and particularly to prevent contamination of the concrete around the reinforcement by mud or sand.

REINFORCEMENT.

9. The distance from the face of reinforcing steel tion of 250,000. The rainfall on this watershed to the face of the concrete in monolithic sewers should be not less than 2 inches.

10. In all important work specify that the reinforcement shall be held in place with steel chairs or holders and wire tires.

11. In determining dimensions of concrete and reinforcement the following working stresses should be the maximum used:

(a) The maximum working stress in the steel where structural grade is used should be not more than 12,000 pounds, and for intermediate or hard grades, or for cold twisted bars, 16,000 pounds per square inch.

The maximum working stress in rail steel should not exceed 16,000 pounds per square inch.

CONCRETE STRESSES.

(b) The maximum working stresses in concrete are based on the report of the Joint Committee on Concrete and Reinforced Concrete, and are about 25 per cent less than the stresses there recommended.

Aggregate.	Class A.	Class B.	Class C.
Granite or trap rock.....	550	450	350
Gravel or hard limestone...	500	400	325
Soft limestone or sandstone (if permitted)	375	300	250

WORKING STRESSES IN POUNDS PER SQUARE INCH.

Soft limestone and sandstones are prohibited if the accompanying specification is rigidly carried out.

These stresses should be further reduced where construction conditions are likely to be very unfavorable to good workmanship, as in very wet or very deep trenches.

12. Attention is called to the fact that with sewers having comparatively flat inverts, careful consideration must be given to the distribution of load across the invert. Where soils are likely to be compressible, the weight should be taken as uniformly distributed. The stresses in such inverts should be carefully analyzed, as they are generally more severe than the other parts of the sewer.

It will generally be advisable to provide alternate details of the invert for use in rock cuts, when resting on rock or nearly incompressible soils and for soft or wet ground.

13. Accompanying specifications for monolithic work provide for either a granolithic finish on the invert or for a lining of concrete block, brick or tile. The use of the separate lining should be considered as an additional factor of safety where unsatisfactory construction conditions are likely to affect adversely the quality of workmanship and the strength or density of the finished invert concrete.

Concrete Sewer Invert Construction

The standard specifications recommended by the committee of the American Concrete Institute provide that:

Section 45. On all sections having a comparatively flat invert, the complete invert shall first be built, while on all circular sections a center strip of not less than one-fourth circumference shall be built. The invert of center strip shall be placed in sections of not over 16 feet where the surface is to be finished with end guides and a longitudinal straight edge, and not more than twenty feet if a separate lining of vitrified brick, tile or concrete block is to be provided.

*Class "A" Concrete—1 bag of Portland cement, 2 cubic feet fine aggregate, 4 cubic feet coarse aggregate. Class "B" Concrete—1 bag Portland cement, 2½ cubic feet fine aggregate, 5 cubic feet coarse aggregate. Class "C" Concrete—1 bag Portland cement, 3 cubic feet fine aggregate, 6 cubic feet coarse aggregate.

Section 46. A granolithic finish shall be applied to the fresh concrete as soon as the condition of its surface will permit. This finish shall consist of a mixture of one part of cement to two parts of granite, or other hard rock chips, graded from ⅛ inch to ½ inch in size, and shall be laid 1½ inches thick. The upper surface shall be formed by means of screeds and shall be floated and troweled to a smooth surface. As soon as this surface is dry enough to receive it, a dry mixture of two parts of cement and one part of sand, free from crusher dust and particles larger than ⅛ inch shall be sprinkled over it and then the surface shall be floated and troweled. This treatment shall be repeated at least once, and where the proportion of very fine material in the aggregate necessitates it, a total of three dryer coats shall be applied. Where the placing of the dryer coat must be deferred until the day following the pouring of the concrete invert, the concrete shall be first moistened and covered with neat cement, which shall be thoroughly broomed into the concrete in the form of a thick paste.

Section 47.* Where required, the inverts shall be lined with concrete block, tile, or vitrified brick, as shown on the plans.

47.1. The concrete bottom shall be accurately shaped up to a line one-half inch below the bottom of the lining and allowed to set before the lining is laid. A mixture made of one part of Portland cement and three parts of sand, without the addition of water, shall be spread on the finished surface to the depth required to bring the block or brick to the required grade. The lining units shall be laid in straight lines and all joints broken. After being laid it shall be brought to solid bearing by a 300 to 500 -pound-hand roller, or by tamping, and the joints shall be grouted with 1:2 mortar and the surface brushed until every joint is filled.

(To be concluded)

Enormous Hydro-Electric Plant Possible

The construction of a hydro-electric plant, larger than any now existing in the world, will become possible if Congress passes the water power leasing bill now pending. In this event it is expected that the General Electric Company or one of its subsidiaries will get the lease of the Priest Rapid site on the Columbia River where there can be developed an hydraulic plant with a maximum capacity of 700,000 h. p. in high water, and 400,000 h. p. in low water. This will involve the construction of a dam 85 feet high across the Columbia River below which all the land may come under a gravity ditch.

Drainage for Houston

The report of J. C. McGea, city engineer of Houston, shows that only 3,290 acres of the 21,247 acres included within the city limits are served by underground drainage, and that the drained area requires 10 per cent more drains to make the system effective.

Drains are especially needed for 6,515 acres of developed territory and the report recommends the creation of a system including the entire city to be constructed at an approximate cost of $9,171,000 which would be fully justified by its economy and efficiency.

* This construction is particularly applicable to sewers having comparatively flat inverts, and is more difficult to carry out with circular sewers.

Tractor Use in Providence

The city of Providence, Rhode Island, owns and uses a tractor to which it attaches an asphalt distributor of 1,500 gallons capacity. It also uses a 6-yard, 10-ton trailer body for the distribution of other paving materials. City Engineer M. H. Bronsdon reports that both of these have given very good satisfaction. No ton-mile costs are available at this time which would furnish definite figures concerning operation of the tractor and trailers.

Mr. Bronsdon states that: "Inasmuch as street construction and street repair performed by municipalities extend over only six months of each year, it is desirable to perform as much of this work as possible in the early part of the year, and it is also desirable to use motor-driven apparatus to obtain the greatest capacity. Horse-drawn vehicles are satisfactory on short hauls, but are certainly too slow for hauls of one mile or greater. Also it is more advantageous in constructing new streets by the penetration method to keep horses off the broken stone during construction after the stone has been rolled.

"It is my belief, however, that while building roads by the penetration method, lighter loads should be carried over rolled stone, before the penetration of asphalt takes place, than results by the use of a 1,500-gallon tank distributor drawn by a tractor. It would be more satisfactory, I believe, to have two 4-wheeled trucks, each with tanks of approximately 800 gallons, in order to carry on work at two locations and with smaller gangs. It is also more difficult to find operators capable of handling a tractor and trailer than operators to handle 4-wheeled trucks or distributors."

Municipally Owned Asphalt Plants

The following list of municipally owned asphalt plants in the United States, Canada and some other countries has been furnished by Charles A. Mullen, of Milton Hersey Co., of Winnipeg. It is presumed that this list is complete to date:

Atlanta, Georgia.
Bayonne, New Jersey.
Bluffton, Indiana.
Boise, Idaho.
Brooklyn, New York.
Buenos Aires, Argentina.
Camden, New Jersey.
Charlottetown, P. E. I.
Chatham, Ontario.
Chicago, Illinois.
Chicago, Illinois, Lincoln Park.
Cincinnati, Ohio.
Cleveland, Ohio.
Columbus, Ohio.
Dayton, Ohio.
Denver, Colorado.
Detroit, Michigan.
Duluth, Minnesota.
Elmira, New York.
Erie, Pennsylvania.
Fall River, Massachusetts.

Fayette Co., Kentucky.
Flint, Michigan.
Fort Wayne, Indiana.
Fort Worth, Texas.
French Government.
Hamilton, Ontario.
Harrisburg, Pa.
Honolulu, Hawaiian Islands.
Indianapolis, Indiana.
Kansas City, Missouri.
Kingston, Ontario.
Lansing, Michigan.
Lima, Peru.
Lincoln Park Commission, Chicago, Illinois.
Little Rock, Arkansas.
London, Ontario.
Los Angeles, California.
Manchester, New Hampshire, Vermont.
Manhattan Borough, New York City.
Memphis, Tennessee.
Milwaukee, Wisconsin.
Montreal, Quebec (4 plants).
Munro City, Kentucky.
Munroe County, Michigan.
Nashville, Tennessee.
Newark, New Jersey.
New Bedford, Massachusetts.
New Orleans, Louisiana.
New York City, Brooklyn.
New York City, Manhattan.
New York City, Queens.
Niagara Falls, New York.
Norfolk, Virginia.
Oklahoma City, Oklahoma.
Northampton, Massachusetts.
Omaha, Nebraska.
Ottawa, Ontario.
Pawtucket, Rhode Island.
Pittsburgh, Pennsylvania.
Portland, Oregon.
Portsmouth, Virginia.
Queens Borough, New York City.
Reading, Pennsylvania.
Saint Louis, Missouri.
Saint Paul, Minnesota.
Saginaw, Michigan.
San Francisco, California.
Schenectady, New York.
Scranton, Pennsylvania.
Seattle, Washington.
Sherbrooke, Quebec.
Shreveport, Louisiana.
Spokane, Washington.
Springfield, Massachusetts.
Superior, Wisconsin.
Syracuse, New York.
Topeka, Kansas.
Toledo, Ohio.
Toronto, Ontario.
Trenton, New Jersey.
United States Government (12 plants).
Victoria, British Columbia.
Washington, District Columbia.
Wilmington, Delaware.
Winnipeg, Manitoba.
Worcester, Massachusetts.
Youngstown, Ohio.

A Profitable Municipal Water System

The city of Jonesboro, Arkansas, has a unique and enviable record for having installed and maintained a public water and light system that has very nearly paid for itself with total profits aggregating $383,540 during 13 years of municipal ownership with an invested capital of $133,604. Besides yielding an average net profit of $29,503 a year, the system is paying for a $100,000-sewer system and the consumers are getting the lowest water and light rates of any city in the state. Every unit in the plant is duplicated so as to keep one in reserve for emergency. The estimated present worth of the plant is $500,000. The secretary of the city board of improvements publishes an acknowledgment to Manager J. F. Christy for his efficiency and farsightedness.

Pittsburgh Water and Typhoid

Before the city of Pittsburgh had filtered water, the death rate from typhoid fever was approximately 130 per 100,000 population annually, but since the filtration of the water, it has been reduced until last year it was 4 per 100,000, thus showing that in the 13 years since the filtration plant was put in operation, the number of deaths has been reduced 31 times, practically eliminating it. At this rate, and assuming the value of a human life at $3,000, the cost of the plant is saved every 18 months. In 1919 the plant purified more than 44,000,000,000 gallons of water.

Power for a City Planning Commission

There has recently been submitted to the Mayor of Syracuse, N. Y., a bill creating a city planning commission to consist of four appointed members besides the city engineer, corporation counsel and commissioner of public safety, ex-officio members, which are to have their present powers of controlling the opening of streets enlarged by the jurisdiction over monuments in parks and public places, street lighting, decoration of the streets for public celebrations, and, most important of all, the power to describe zones limiting manufacturing and merchandising and thus becoming an administrative and legislative agency rather than a merely advisory agency with the majority of its membership directly responsible to the Mayor and having its decisions subject to review by the common council which may reverse them by two-third vote.

Extensions of Federal Road Aid in West Urged

Extension of Federal aid in road building from the equal federal and state appropriations to a ratio basis determined by the acreage of non-taxable Government lands has been strongly urged on Congress by delegates appointed by the governors of fourteen public land states west of the Mississippi and by Governor Riggs of Alaska.

City officials of Akron are considering a proposal to either have the city take over and operate the street car lines in that city, or have Akron business men form a company for this purpose. According to the business men, they believe it would be possible to raise sufficient money to purchase the lines valued at approximately $4,500,000.

Cleveland is again giving consideration to a plan for a freight subway to connect the Lake Erie shore at the eastern section of the city to the southern industrial district and co-operate with a ferry line to Canada by which loaded freight cars could be transferred for Canadian points.

LEGAL NOTES

A Summary and Notes of Recent Decisions—

VERIFICATION, POSTING AND FILING OF NOTICE DISCLAIMING LIEN LIABILITY.

(Cal.App.) Code Civ. Proc. § 1192, as amended by St. 1911, p. 1313, providing that the owner of premises may relieve himself from liability for work, labor, or materials furnished upon the same by posting notice in writing to that effect in a conspicuous place on the property and filing a verified copy in the office of the county clerk, must be strictly complied with to relieve an owner from responsibility for labor done or materials furnished, etc.—Pasqualetti v. Hilson, 185 P. 693.

Where the owner of premises posted a written notice that he would not be liable for work, labor or materials furnished thereon, and filed for record a copy of such notice containing his acknowledgment thereof before a notary public, there was not a sufficient compliance with Code Civ. Proc. Sec. 1192, as amended by St. 1911, p. 1313, requiring copy of such notice to be verified, to free the owner from liability, for an acknowledgment before a notary is not equivalent to a verification.—Id.

Where the owner of premises had posted a written notice in compliance with Code Civ. Proc. Sec. 1192, as amended by St. 1911, p. 1313, that he would not be responsible for work, labor or materials furnished upon the premises, but failed to comply with the exact requirements of the section, as to recording of verified copy of such notice, he is liable to persons furnishing labor and materials at the request of lessees of the premises, though such persons had actual knowledge of the posting of the notice of nonliability.—Id.

SUBCONTRACTORS' AND CONTRACTORS' WORKMEN AND MATERIALMEN.

(Ind.) A direct and positive covenant in principal contract against right of any one to lien precludes all, who work under, or furnish materials to, the principal contractor, from having a lien.—Baldwin Locomotive Works v. Edward Hines Lumber Co., 125 N. E. 400.

Subcontractors and materialmen are bound to know what is in the principal contract, and so that it contains a direct and positive covenant against liens.—Id.

Provision in building contract, permitting the owner to retain payment from the principal contractor till liens are discharged, is not sufficient to overthrow and abrogate the direct and positive covenant therein against liens.—Id.

(Tex. Civ. App.) Where no installment of the price of the work was due the contractor for work done when a materialman or a mechanic gave notice to the owner's agents for the purpose of receiving such notice, the materialman or mechanic secured no right against the owner or the property, through the giving of such notice, accompanied by presentation of an order for payment from the contractor, claimed to operate as an assignment.—Leeper-Curd Lumber Co. v. Barbuzza, 216 S. W. 216. (Wis.) A subcontractor on a building which has perfected its lien for work, labor, and material furnished, the greater part before the date of the contractor's assignment to a bank of funds or payments due, has a prior and superior right to payment from such funds over that of the bank.—Neil & Co. v. Sedlachek, 175 N. W. 89.

A contractor's bondsman, which has no subsisting claim for moneys previously paid by it on account of its liability as surety to release any lien on the owner's property or for any claims paid by it constituting a superior and prior claim to that of a bank as creditor of the contractor on the funds received on the building contract, has no superior equitable right over that of the bank, assignee from the contractor of moneys due, to the amount due the contractor from the owner.—Id.

PROCEEDINGS TO PERFECT.

(Wis.) Where the last labor and material were furnished by a subcontractor in August within 60 days of September 19th, when the subcontractor by its attorney sent a letter to the person who represented the owner and the contractor's bond, which letter, though lacking the usual formality of a notice of lien and containing some immaterial matters, nevertheless stated the amount due the subcontractor for work, labor, and materials furnished, and claimed a lien, such letter was also such a notice as is required by St. 1913, Sec. 3315.—Neil & Co. v. Sedlachek, 175 N. W. 89.

(Wis.) Notice of claim of mechanic's lien required by St. 1913, Sec. 3315, may be served on the owner or his agent in a county other than where the property is located, and need not, if service cannot be made in such county, be filed in the office of the clerk of the circuit court of the county.—Neil & Co. v. Sedlachek, 175 N. W. 89.

MATERIAL MEN NOT RESPONSIBLE EXCEPT TO PURCHASER.

(La.) Materialman, who was not a party to contract between paving contractor and parish, was not responsible to contractor in damages ex contractu upon breach of its contract with parish to deliver material, though contract between contractor and parish provided that contractor should have recourse against materialman for his losses upon materialman's failure to deliver according to its contract with parish.—Police Jury for Parish of St. Landry v. Alexandria Gravel Co., 83 So. 316.

SURETY NOT LIABLE FOR SHOVEL RENT.

(Cal.App.) A surety on a bond of a state highway contractor, made pursuant to the provisions of St. 1897, p. 201, amended by St. 1911, p. 1422, was not liable to one who leased a steam shovel to another, who furnished the shovel to a subcontractor, although it was agreed between the subcontractor and the one who furnished him the shovel and the lessor of the shovel that the rent for the shovel should be paid to the lessor, and an order on the contractor was given by the subcontractor for the payment of the same; the subcontractor agreeing, but failing to pay the same to the lessor, and the one furnishing the shovel not being agent for the lessor under the circumstances.—Norman B. Livermore & Co. v. Guardian Casualty Co., 185 P. 413.

NEWS OF THE SOCIETIES

April 27-29—CHAMBER OF COMMERCE OF THE UNITED STATES. Eighth annual meeting, Atlantic City.

May 4-6.—NATIONAL FIRE PROTECTION ASSOCIATION; Chicago. Secretary, 87 Milk street, Boston.

May 10-11.—AMERICAN ASSOCIATION OF ENGINEERS. Sixth Annual Convention, St. Louis, Mo. Secretary, C. E. Drayer, 63 East Adams Street, Chicago.

May 13-14-15.—LEAGUE OF TEXAS MUNICIPALITIES. The eighth annual convention will be held at Dallas, Tex. Secretary-Treasurer, Frank M. Stewart, University of Texas, Austin, Texas.

May 18-21.—NATIONAL ELECTRIC LIGHT ASSOCIATION. Annual convention, Pasadena, Cal. Acting Secretary, S. A. Sewall, 29 West 39th Street, New York City.

June 21-25.—AMERICAN WATER WORKS ASSOCIATION. Annual meeting, Montreal, Canada. Secretary, John M. Diven, 153 West 71st Street, New York City.

June 22-25.—AMERICAN SOCIETY FOR TESTING MATERIALS; Asbury Park, N. J. Office of secretary, Philadelphia.

June 22. JOINT COMMITTEE ON STANDARD SPECIFICATIONS FOR CONCRETE AND REINFORCED CONCRETE. Next meeting at Asbury Park. Secretary-treasurer, D. A. Abrams, Lewis Institute, Chicago.

Aug. 30-Sept. 3.—AMERICAN PUBLIC HEALTH ASSOCIATION; San Francisco. Office of secretary, Boston.

Oct. 4-8.—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention, St. Louis, Mo. Secretary, Charles Carroll Brown, 404 Lincoln Avenue, Valparaiso, Ind.

Texas Roadbuilders' Association.

The first meeting was held at Austin, Texas. Six sessions were held, besides an illustrated lecture by the representative of the Lakewood Engineering Co., and a meeting for perfecting the organization.

Reports were presented on work by the division engineers of the State Highway Department, and an address by C. N. Fowler, member of the State Highway Commission, on "Future Federal and State Participation in Highway Construction."

Among others the following papers were presented: "Relation of Federal Bureau of Public Roads to State and Federal Aid Projects," by J. D. Fauntleroy, District Engineer, U. S. Bureau of Public Roads; "Relation of State Highway Department to State and Federal Aid Projects," by C. H. Kendall, Assistant State Highway Engineer of Texas; "State and Federal Aid Projects from Contractor's Viewpoint and Suggestions for Betterments," by G. C. Hawley, of the Texas Bitulithic Co.; "Relation of Counties to State and Federal Aid Projects; Present Conditions as to Co-operation and Suggestions for Betterments," by F. E. Hess, of Dallas; "Misunderstanding Concerning Functions of State Highway Department," "Federal Equipment—the Handling by the State after its Receipt; Organization Methods"; "Desirability of Building More Permanent Types of Roads," by R. V. Glenn, Consulting Engineer of Tarrant County; "Surveys and Plans—Present Methods of Preparation and Recommendations for Betterments," by Julian Montgomery, County Engineer of Rockwall County; "Drainage Problems and Designs of Modern Highway Drainage Structures," by G. G. Wickline, Bridge Engineer of the Texas State Highway Department; "Road Materials—State's Relation to Location and Development of Sources and Transportation," by T. H. Webb, Engineer of Materials and Tests, Texas State Highway Department; "The County Engineer," by Terrell Bartlett, of San Antonio; "Road Materials—Testing and Grading," by R. G. Tyler, Associate Professor of Highway Engineering, University of Texas; "Special Construction Features," by W. O. Washington, of Whiteaker & Washington, San Antonio; "Aggregate and Methods of Preparing Concrete Mixtures," by F. E. Geisecke, Chief Division Engineer, Bureau of Economic Geology and Technology, University of Texas; "Making Concrete for Highway Pavements and Bridges," by L. H. Edwards, Senior Highway Bridge Engineer, U. S. Bureau of Public Roads; "Topeka Pavements," by R. M. Green, Professor of Highway Engineering, Texas Agricultural and Mechanical College; "Bituminous Surface Treatments," by M. C. Wellborn, Division Engineer, Texas State Highway Department; "State Organization for Highway Maintenance," by R. J. Windrow, State Highway Engineer; "County Organization for Highway Maintenance," by Manton Hannah, County Engineer of McLennan County, Texas.

At the organization meeting it was decided to hold meetings semi-annually, one to be at Austin and the other at a place selected by vote of the members. An invitation to hold a meeting at Waco was accepted.

Officers elected: President, R. J. Tyler, Associate Professor of Highway Engineering, University of Texas; vice-president for North Texas, R. V. Glenn, Consulting Engineer of Tarrant County, Ft. Worth; vice-president for South Texas, L. W. Kemp, of The Texas Co., Houston; vice-president for East Texas, N. B. Gregory, Contractor, Texarkana; vice-president for West Texas, E. M. Overshiner, County Judge of Taylor County, Abilene.

Four directors, one engineer, one contractor, one material man and the other a county official, were elected. J. C. Nagle, Dean of Engineering Department, Texas Agricultural and Mechanical College, engineer; R. J. Potts, of Potts & Prentice, Waco, contractor; E. L. Dennis, Jr., of the Texas Trap Rock Co., San Antonio, material man; and Cecil L. Simpson, County Judge of Dallas County, Dallas, county official.

PERSONALS.

Fulton, Clyde, has been appointed city manager of Roswell, N. Mex.

Buck, Ross J., has been appointed city engineer of Muskegon, Mich.

Sperbeck, George, has been appointed assistant city engineer of Alameda, Cal.

Greer, J. W., has been appointed city manager of Tallahassee, Fla.

Firth, Joseph, has been appointed city manager of West Palm Beach, Fla.

Austin, George T., has been appointed city engineer of Effingham, Ill.

Otter, Gus, has been appointed county engineer of Ashland County, Ohio.

Umland, B. F., has been appointed highway engineer of Pennsylvania County.

Clark, LeRoy F., has resigned as city engineer of Batavia, N. Y.

West, W. C., of Buckhannon, W. Va., has been appointed road engineer of Houghton County, Mich.

Calkins, A. S., has been appointed city engineer of Joliet, Ill.

Murray, Joseph A., Jr., has been appointed principal assistant in the city bureau of engineering of Albany, N. Y.

Allen, Judge B. M., of Birmingham, Ala., has been elected president of the Bankhead National Highway Association.

The Blinn Engineering Co., Coshocton, O., has been organized by Ray S. Blinn, for municipal engineering practice.

Wespiser, Joseph, and Vanausdall, A. D., will engage in the contracting business at Oxford, Ohio.

Nevin, James R., has been elected county engineer of Jefferson County, Iowa.

Cooper, W. J., Hilton, F. E., and Mann, Harold, have organized the General Industrial Corporation for engineering and contracting at Kemmerer, Wyo.

Kidd, Herbert L., has been appointed city manager of Kingsport, Tenn.

New Appliances

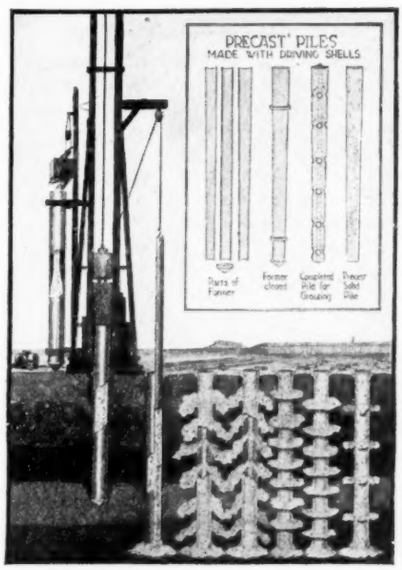
Blumenthal-Gardner Concrete Piles

The Concrete Pile and Foundation Company offers a system of concrete foundation piles with new details of design and construction methods intended to facilitate their installation and increase their bearing power in soft soils.

Important features are the use of a longitudinally split detachable steel driving form that it is claimed can be used and removed more advantageously than the ordinary single-piece shell, and the use of temporary and perforated steel shells permitting the formation of exterior projections made by ramming concrete in the body of the pile until it is forced out through the openings into the surrounding soil. As many as 200 2-inch projections are estimated to be produced on the surface of a 16-inch pile 30 feet long.

Other features are the formation of mushroom extensions at the base and at intermediate positions of the pile above it and the use of a system of interior pipe manifolds, embedded in the concrete of the pile and permitting the application of grout after the pile is driven, to penetrate the exterior soil.

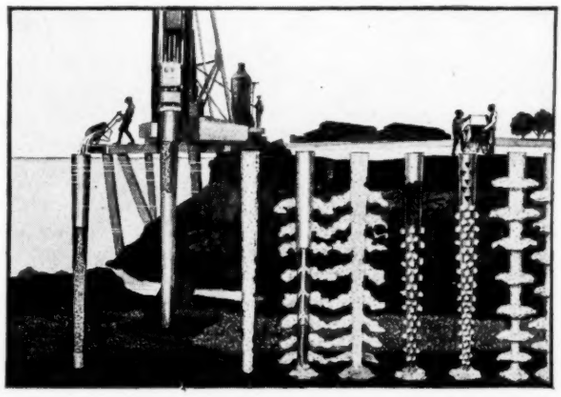
The inventors provide a waterproof lining to be inserted in the field shell and filled with concrete before the pile is driven with the intention of securing protection from running water or from acids. A device is also provided for enlarging a cavity produced at the foot of the pile so that when concreted, projecting arms will be formed there. Advantages are also claimed for a process of filling the shells with wet concrete before driving and thus securing extra density of the concrete.



PERFORMING THREE OPERATIONS AT ONE TIME, FILLING SHELL, DRIVING SHELL, AND WITHDRAWING SHELL.

The same split shells that are used for the cast-in-place piles are equally available for casting piles on the surface of the ground which may be stripped and left to season before driving. Rapidity of operation and superiority of piles is claimed for a method worked out for the installation of these piles whereby 3 successive operations are simultaneously in progress continuously, namely, the filling of one pile shell upon the surface of the ground, the driving of the next pile, and the removal of the shell from the second pile, all operated from the same driving tower.

This type of construction, called the Blumenthal-Gardner system, is recommended by its promoters, the Concrete Pile and Foundation Co., for foundations and continuous retaining walls, for operation under water.



DRIVING CAST-IN-PLACE CONCRETE PILES THROUGH WATER OR WATER SOILS, USING EITHER FILLED SHELL OR FILLING AFTER SHELL IS DRIVEN

The Clark Meter Box.

The cylindrical vitrified meter box with locked sections cover manufacturer by the H. W. Clark Co. are recommended by that company for ten reasons: first, ready access for reading, inspection and repair at all times; second, reading of meter without annoyance to consumer; third, meter may be read at any time regardless whether or not the occupants of premises are at home; fourth, detection of underground and all other leaks in entire service line and fixtures; fifth, prevention of bypassing connections in front of meter; sixth, absolute protection to meter from frost; seventh, protection to meter from fire and damage of all kinds; eighth, protection from tampering with meter by unauthorized persons; ninth, protection to consumer from burglars who often gain admission to the house under guise of meter readers; tenth, protection to the water department from personal injury damage suits arising from persons stepping or falling into unprotected meter boxes.

INDUSTRIAL NOTES

Important Announcement.

The Highway Materials Department of the H. H. Robertson Company has been purchased by the National Steel Fabric Company of Pittsburgh, Pa., and the balance of all unfilled fabric orders will be shipped by the National Steel Fabric Company.

Correspondence relating to past contracts or new business should be addressed to the National Steel Fabric Company, First National Bank Building, Pittsburgh, Pa., of which E. L. Benedict, formerly manager of the H. H. Robertson Co.'s Highway Materials Department, is general sales manager.

National Data Book Service.

Holders of Robertson Data Books are advised that the National Steel Fabric Company takes pleasure in announcing that the service rendered last year to those indirectly and directly interested in highway affairs will be continued as the National Data Book Service.

The National Steel Fabric Company trusts that this service will be of interest to you and assumes that it will have your co-operation in the matter of furnishing accurate information to those interested in permanent highway construction.

The George Cutter Company and the Westinghouse Electric & Manufacturing Company.

The George Cutter Company, of South Bend, Indiana, announces the acquisition by the Westinghouse Electric & Manufacturing Company of a financial interest in their company. The management and the commercial policies will remain unchanged, but advantage will be taken of the Westinghouse engineering and other facilities to expand the Cutter Company's activities and develop its lines to enable it to more effectively serve its customers and the industry. The Westinghouse Company will operate as sole distributors for the Cutter Company's products.

Asphalt Association.

Permanent headquarters have been established at 25 West 43rd Street, New York City.

Pittsburgh Pressure Filters.

Pressure filters manufactured by the Pittsburgh Filter & Engineering Co., are of standard sizes from 6,000 to 150,000 gallons daily capacity and are made vertical and horizontal; with settling compartments for muddy waters; with geared agitator; and with single and double tanks.

The standard horizontal filter, 8 feet in diameter and with capacities of 200,000 gallons a day upwards according to the length are recommended for small water works plants.

Rollin Construction Corporation.

J. J. Collins, W. D. Hammond and Linton Hart, formerly of the Raymond Concrete Pile Company and the Dock Contractor Company, announce the Rollin Construction Corporation, engaging in general construction, with offices at 90 West Street, New York City, and 80 Boylston Street, Boston, Mass.

Advertising Paving Progress.

Windes & Marsh have obtained publicity results which they consider satisfactory in advertising the progress of construction on about 68,000 yd. of concrete street pavement that is being executed under their direction at Winnetka, Ill., by the Marquette Construction Co., contractor. A large signboard is erected in the street in a conspicuous place and is marked in large letters, Winnetka South East Paving. 5½ miles reinforced concrete, Progress. Underneath this caption there are three vertical columns headed, Grading, Drainage, and Concrete Laid, respectively. These columns are divided by ten horizontal lines each representing ten per cent of the work, and as the latter progresses the columns are filled in accordingly from the bottom up showing at any moment what proportion of the work is finished. The effect of this diagram has been to interest the taxpayers and to stimulate the contractor who maintains creditable progress.

Liquid Chlorine.

Liquid chlorine under a pressure of about 100 pounds per square inch is shipped in heavy cylinders containing 100 and 150 pounds and in tank cars with a capacity of 30,000 pounds. When released from the tanks or cylinders the chlorine immediately gassifies.

Liquid chlorine is now used in more than 3,000 installations in the United States for the sterilization of water supplies and disinfection of sewage effluents. For the purification of drinking water an example is cited in western New York State where a town suffering from a few cases of typhoid fever purified the drinking water at an operating cost of only 15 cents per day for the liquid chlorine after the installation of the chlorinator. The chlorinators are provided to suit every system, whether pump suction, pressure main, or open well, for the smallest town or the largest city, and are either manually or automatically controlled.

United Iron Works, Co.

Bulletin 50 illustrated several styles of cast iron lamp posts for city lighting. They are designed for 3, 4, or 5 globes, and one type has an upper extension carrying telegraph or telephone wires.

Rapid Gravel Dredging.

Remarkably good results for submerged excavation under difficulties were attained with a derrick barge owned by the Cadwell Sand & Gravel Company, Windsor, Ontario, which was equipped with a 2-yard clamshell bucket operated by 10 by 12-inch American hoisting engine and dug 100 yards of gravel per hour in 40 feet of water with a 9-mile current. This required an average of more than one bucket full per minute and efficient handling to remove the gravel as fast as dredged.

A Large Powerful Roof Derrick.

Ocean steamers are loaded with heavy freight by a 25-ton American derrick installed on the roof of the Union Pacific Pier Shed at Seattle, Washington. It has a 20 by 20-inch 45-foot mast and a 16 by 16-inch, 60-foot boom, with standard fittings. The nominal capacity is 25 tons and it is operated by an American 7 by 10-inch hoisting engine with excess capacity that has handled without difficulty, a large number of 27 ½-ton locomotive boilers but has never required any expense for repairs.

Solvay Graphite Paint.

This paint manufactured by the Solvay Process Company is especially recommended by them for bridges, corrugated iron buildings, and other metal structures, because, being made of amorphous graphite, refined pitch, and vegetable oils, all of which are absolutely inert and resistent to atmospheric influences, it is a very durable covering for iron and steel. It is a black paint with a covering capacity of 550 square feet per gallon, and requires from 24 to 36 hours for drying. Under normal conditions it will last from 3 to 10 years, depending on conditions and the care with which it is applied.

PROBLEMS CITIES ARE STUDYING WITH EXPERTS.

Plans for a $381,000 municipal HYDRO-ELECTRIC POWER PLANT have been submitted to the water commissioner of Walla Walla, Oregon by E. D. Hussey, Seattle, who proposes to generate about 1,000 kilowatts from a flow of 50 secon-feet at 350 head which, allowing for 10 per cent loss in transmission, should deliver about 1,200 h.p. at the city line.

City Engineer Cowden of Harrisburg and engineers representing the Pennsylvania and Reading railroads and the Harrisburg Railway Company have been considering plans for the elimination of GRADE CROSSINGS in the proposed short line to Steelton. One of the plans involves a 334-foot bridge span, another requires a bridge 650 feet long and another requires a 1,000-foot bridge of several spans.

Elrod, Henry E., has been retained by the City of Galveston to appraise the properties of the Galveston WHARF COMPANY and the Brush ELECTRIC COMPANY, for the purposes of taxation and rate regulation, respectively.

The Henry Exall Elrod Company has plans and specifications ready for a DAM for the City of Cisco, to cost approximately $350,000.

It is also in the market for a twelve-ton municipal GARBAGE INCINERATOR for the City of Cisco, Texas.

The Mangum, Oklahoma, Board of Commissioners have retained Johnson & Benham, consulting engineers, Kansas City, Missouri, as consulting and supervising engineers for an elaborate system of STREET PAVING which is being planned. The first district will comprise only the business district, but later it is expected to extend the work to cover a great portion of the residence district. It is estimated that the work will total $600,000.